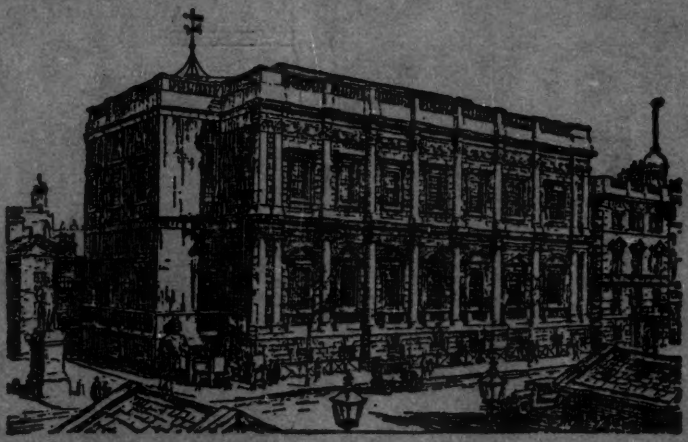
AUGUST 1955

JOURNAL



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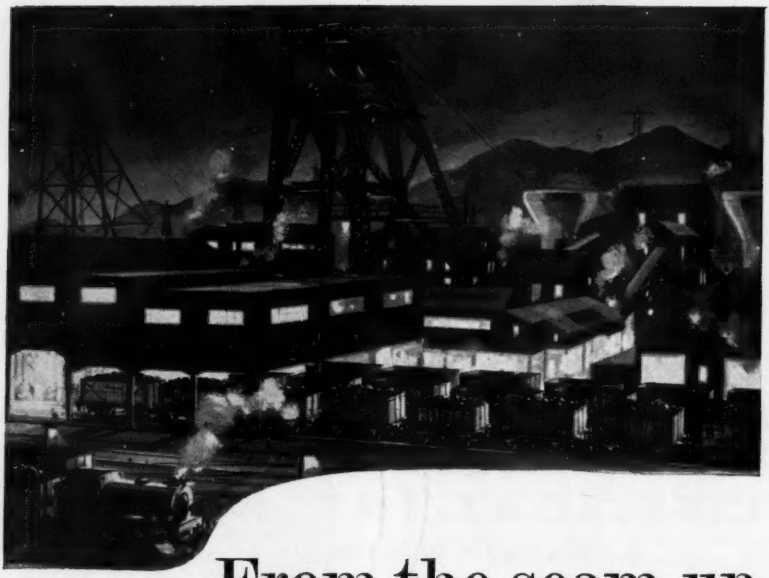

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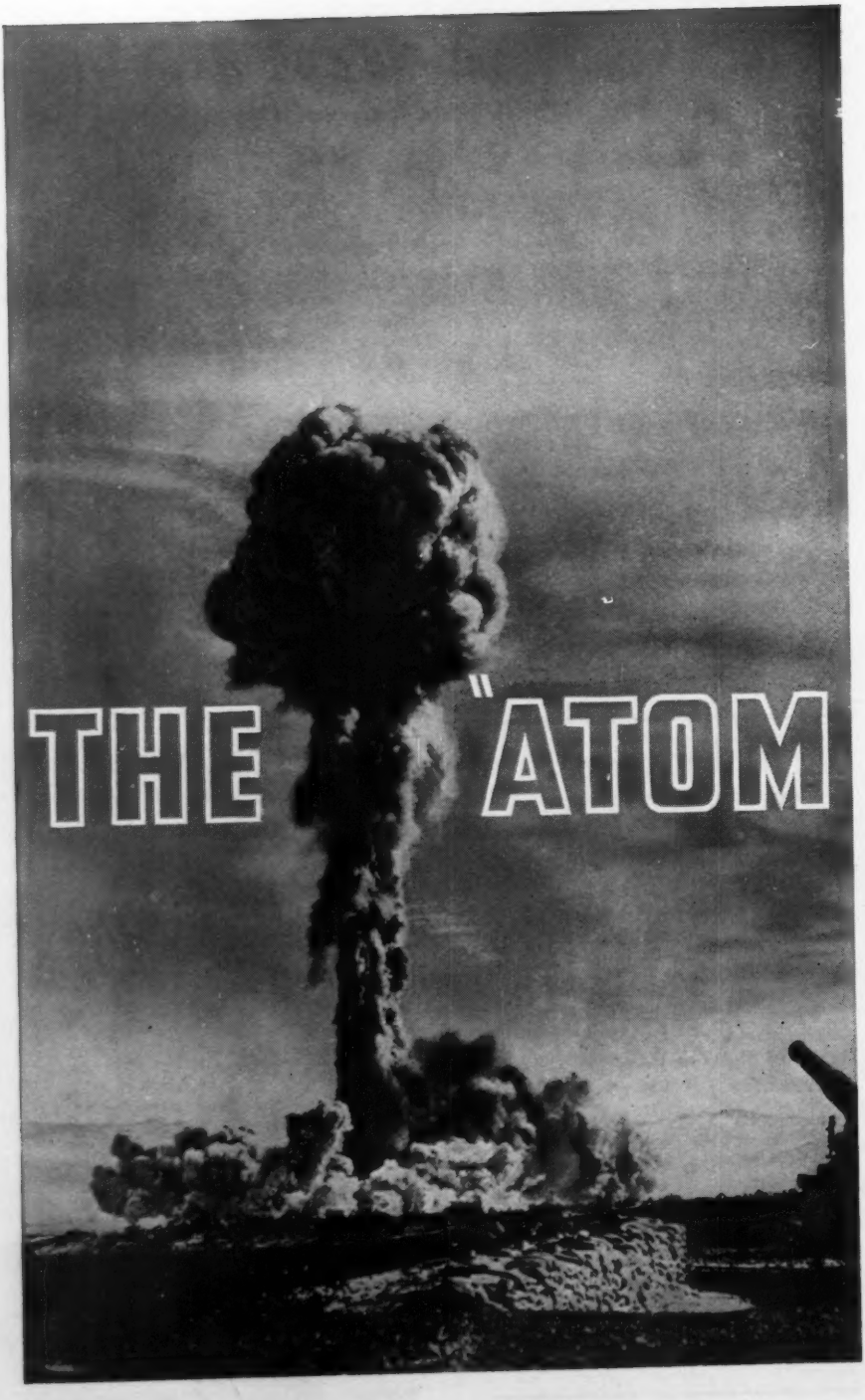
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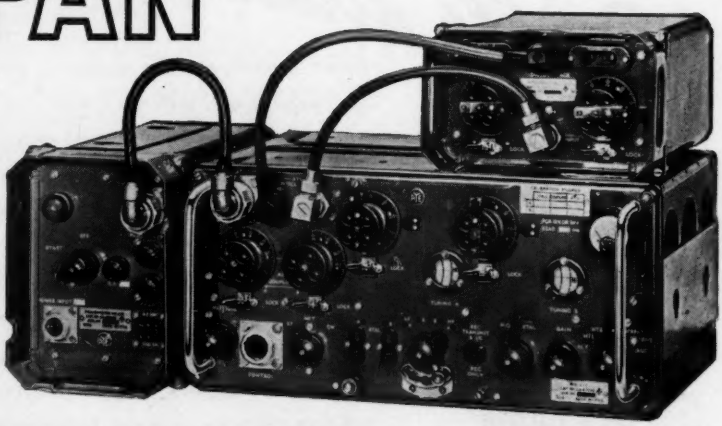

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The Institution is situated opposite the Horse Guards in Whitehall. It provides members with a comfortable reading room containing the leading papers, periodicals, and principal Service (including foreign) Journals.

There is a lecture theatre where lectures are given followed by discussions in which officers of every rank are encouraged to take part.

Members can obtain on loan four volumes at a time from the best professional library in the Country. They are provided with a free copy of the JOURNAL.

There is a private entrance to the celebrated R.U.S. Museum in the former Banqueting House of old Whitehall Palace.

MEMBERSHIP

Commissioned officers on the active and retired lists of all H.M. Services, including those of the Dominions and Colonies, also midshipmen of the Royal and Dominion Navies, the R.N.R., R.N.V.R., and R.N.V.S.R. are eligible for membership without formality.

Retired officers of the Regular and Auxiliary forces, including the Home Guard, whose names no longer appear in the official lists, are eligible for membership by ballot.

Ladies whose names appear or have appeared in the official lists as serving or having served as officers in any of the three Services are eligible as above.

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The JOURNAL is published in February, May, August, and November. Copies may be purchased by non-members, price 10s. 0d.: annual subscription, £2 post paid. Orders should be sent to the Secretary, Royal United Service Institution, Whitehall, S.W.1.

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The R.U.S. Museum is open daily from 10 a.m. to 5 p.m., except on Sundays, Christmas Day, and Good Friday. Members may obtain free passes for their friends on application to the Secretary.

Members of the Services in uniform are admitted free.

SECRETARY'S NOTES

August, 1955

COUNCIL

Elected Member

Lieut.-General Sir Colin B. Callander, K.C.B., K.B.E., M.C., has been elected to the vacancy caused by the resignation of Lieut.-General G. W. Lathbury, C.B., D.S.O., M.B.E., on posting overseas.

Ex Officio Member

Admiral The Earl Mountbatten of Burma, K.G., P.C., G.C.B., G.C.S.I., G.C.I.E., G.C.V.O., D.S.O., has accepted the invitation of the Council to become an ex officio Member of the Council on taking up the appointment of First Sea Lord and Chief of Naval Staff.

MEMBERSHIP

Civilian officials, who are attending or have attended a course of instruction at the Imperial Defence College or the Joint Services Staff College, are eligible for membership of the Institution by ballot of the Council. Applications should be made to the Secretary, who will be glad to give full particulars.

NEW MEMBERS

The following officers joined the Institution between 19th April and 26th July, 1955 :—

NAVY

Captain T. Morgan, M.M., R.M.
Lieutenant-Commander J. B. P. Stirling, R.N.
Lieutenant R. M. Lees, R.N.

ARMY

Captain V. T. M. R. Tenison, Royal Artillery.
Major W. F. Cooper, M.C., Royal Engineers.
Lieut.-Colonel G. C. Hill, The Wiltshire Regiment.
Lieut.-Colonel J. C. Thomas, R.A.O.C., T.A.R.O.
Captain J. R. Rigby, Royal Artillery.
Lieutenant D. B. Edwards, The Dorset Regiment.
Captain M. G. L. Roberts, Royal Engineers.
Brigadier J. E. C. Pangman, D.S.O., E.D., Canadian Army.
Lieut.-Colonel F. D. Pile, M.C., Royal Tank Regiment.
Major W. L. Archer, late Canadian Army.
Lieut.-Colonel T. C. Sinclair, M.C., The Rifle Brigade.
Colonel T. H. F. Foulkes, O.B.E., Royal Engineers.
Captain E. Byrne, London Irish Rifles, T.A.
2nd Lieutenant J. C. C. Russell, The Queen's Own Cameron Highlanders.
Major B. A. Head, Royal Artillery.
Major A. R. Wythe, Royal Signals.
Lieutenant G. L. D. Duckworth, Royal Tank Regiment.
Lieutenant J. Darlington, Royal Tank Regiment.
Major-General H. Essame, C.B.E., D.S.O., M.C.
Captain A. H. Simpson, 9th Queen's Royal Lancers.
Captain D. W. Shuttleworth, The Duke of Wellington's Regiment.
Captain H. D. Rogers, Royal Artillery.
Lieut.-Colonel P. W. Mead, Royal Artillery.
Lieutenant M. Y. Johnson, The East Lancashire Regiment.
Captain P. W. Aisthorpe, Royal Pioneer Corps.

2nd Lieutenant A. E. Hopkinson, Scots Guards.
Captain R. W. Hooper, R.A.S.C.
Captain R. C. Mowat, late Intelligence Corps and R.A.E.C.
Major R. D. Watson, Canadian Army.
Captain A. W. Cheyne, The Royal Warwickshire Regiment.
Lieutenant J. J. Bray, The Canadian Guards.
Major T. R. Fisher, The Royal Norfolk Regiment.
Captain D. V. E. Howard, T.D., Honourable Artillery Company.
Lieutenant S. Zakir A. Zaidi, 6th/8th Punjab Regiment.
Captain C. M. A. Mayes, Coldstream Guards.

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The Council hope that many more members will support the scheme for covenanted subscriptions, details of which have been circulated.

This materially assists the Institution as it enables income tax at the full current rate to be reclaimed on each subscription and goes a long way towards meeting the increased essential costs of administration. The Council wish to thank the many members who have re-covenanted since the beginning of the year.

To date, there are 1,291 annual and 253 life covenanted members.

Any member who has not received his copy of the scheme or who requires new forms is requested to communicate with the Secretary.

LIAISON OFFICERS

In the list of Liaison Officers published in the JOURNAL for May, 1955, "R.N. Barracks, Devonport" should read :—

Establishment or Command	*Name*
Devonport	Commander L. E. S. H. Le Bailly, R.N., H.M.S. *Thunderer*.

Other alterations to the list of Liaison Officers, as published in the February JOURNAL, are :—

British Joint Services Mission, Washington.	Commander B. C. Moth, M.B.E., R.N.
British Troops in Egypt	Major M. W. Brennan.
Coastal Command...	Wing Commander R. E. G. Van der Kiste, D.S.O., R.A.F.

MUSEUM

Additions

An officer's full-dress uniform of the 1st Volunteer Battalion, The Royal Fusiliers (City of London Regiment), 1886 (9676). Given by Miss D. M. Potter.

An officer's full-dress uniform of the 5th Royal Irish Lancers, 1900 (9677). Given by Mrs. S. Williams.

Serbian gold and silver medals awarded for zeal and devoted service in the 1914–18 War (9678). Given by the War Office.

JOURNAL

Offers of suitable contributions to the Journal are invited. Confidential matter cannot be used, but there is ample scope for professional articles which contain useful lessons of the recent war; also contributions of a general Service character, such as strategic principles, command and leadership, morale, staff work, and naval, military, and air force history, customs, and traditions.

The Editor is authorized to receive articles from serving officers, and, if found suitable, to seek permission for their publication from the appropriate Service Department.

Army officers are reminded that such articles must be accompanied by the written approval of the author's commanding officer.

LECTURES

The programme of lectures for the first half of the 1955–56 session is published with this number of the Journal. Certain lectures are restricted to members only and no exception can be made to this rule other than for guests officially invited by the Council.

There is an extension of the loudspeaker system from the Lecture Theatre to the Reading Room for use as required. Members and their guests will on arrival be accommodated in the theatre until it is full, when the excess number will be directed to the Reading Room.

Tickets will not be issued for any lectures in future and seats cannot be reserved, other than for official guests.

REPRINT OF LECTURE

To meet the demand for copies of the lecture *A Look Through a Window at World War III* given by Field-Marshal The Viscount Montgomery of Alamein in October, 1954, a reprint has been made. These are available at 2s. 6d. a copy, post paid.

POSTAL SERVICE BY AIR MAIL

In order to keep the annual membership subscription to the lowest possible rate it is not economic in normal circumstances for the Institution to send letters, etc., overseas by air mail. Members who require answers by this service should enclose the necessary international reply coupons when making an enquiry.

CHANGES OF ADDRESS

Members are particularly requested to notify any change of address which will affect the dispatch of the Journal.

Naval officers are strongly advised to keep the Institution informed of their address, as Journals sent to them via C.W. Branch of the Admiralty are invariably greatly delayed.

As a serving officer is liable to frequent changes of station, it is better for such members to register either a permanent home or a bank address.

CHRISTMAS CARDS

Orders for Christmas cards, specially designed for members of the Institution, can now be placed.

Card A has the crest of the Institution on the outside and inside a reproduction of a black and white sketch of the exterior of the Banqueting House. The price, including envelopes, is 10s. a dozen.

Card B is a reproduction in colour of a combined operation against Louisberg, 1745; inside is the crest of the Institution. The price, including envelopes, is 16s. a dozen.

Postage in each case is 6d. for each dozen by ordinary mail.

Members are requested to ensure that the correct remittance, including postage, is sent with their orders. It is regretted that *orders cannot be executed until payment is made.*

NORTH ENTRANCE TO THE BANQUETING HALL
IN THE MUSEUM OF THE ROYAL UNITED SERVICE INSTITUTION

THE JOURNAL

of the

Royal United Service Institution

Vol. C. AUGUST, 1955. No. 599.

LONG DISTANCE HIGH SPEED FLYING

By WING COMMANDER L. M. HODGES, D.S.O., O.B.E., D.F.C., R.A.F.

On Wednesday, 9th March, 1955, at 3 p.m.

AIR CHIEF MARSHAL SIR JAMES ROBB, G.C.B., K.B.E., D.S.O., D.F.C., A.F.C., in the Chair

THE CHAIRMAN: Since we heard in this hall some years ago about long distance jet flying from the pilot of the Canberra who flew the Atlantic in 1951, great progress has been made in this most important development in military apart from civil flying, and I am sure there is no one better qualified to bring us up to date than Wing Commander Hodges. Not only did he command the flight which was formed in May, 1953, to train in Bomber Command the pilots and the crews on Canberras for the London to New Zealand air race, but in the race in October, he led the way and broke the official record from London to Colombo, flying the 5,400 miles at a speed of 519 miles per hour. As you will remember, he was well ahead of the others when he got to Perth in Western Australia, but, unfortunately, he had electrical trouble which put him out of the lead in that great race.

If some further background is necessary—it concerns something which most officers and the public do not know very much about—he played a prominent part in the work of those two squadrons, 138 and 161, which were engaged in the 1939-45 War in S.O.E. (Special Operations Executive) and S.A.S. (Special Air Service) work for a long period. In 1944 his own squadron, No. 161, did remarkable work not only in dropping agents and supplies to the Resistance Movement in France, but in landing and picking up our own representatives, including one senior officer of the Foreign Office who was a pilot himself and whose Lysander got bogged when he landed over there one night. Wing Commander Hodges was the man who at the second attempt managed to land a Hudson, pick him up, and bring him back.

I shall now ask Wing Commander Hodges to read his paper.

LECTURE

EIGHTEEN months ago the London to New Zealand air race took place, and in that race the Royal Air Force entered three English Electric Canberra photographic reconnaissance aircraft, one of which won the speed section of the race, flying from London Airport to Christchurch, New Zealand, a distance of 12,000 miles in under 24 hours. There were four stops en route, in the Persian Gulf, at Colombo, at the Cocos Islands, and at Perth. The average speed for this remarkable flight, including the time spent on the ground for refuelling, was nearly 500 miles per hour.

This all took place a year and a half ago, and whereas at that time the Canberra was the best aircraft we had for the job, having regard both to speed and range, the

situation today is very different, as we are now entering a completely new phase with the introduction of the 'V' class long range military aircraft—the Valiant, made by Vickers, the Vulcan, made by Avro's, and the Victor, made by Handley Page. The Valiant is the first of these new aeroplanes to come into service, and as has already been announced in Parliament and in the Press, re-equipment has now started and we shall see more and more of the larger four-jet 'V' class aircraft. In the field of civil aviation there is the Bristol Britannia coming along and also the Comet III, both of which will be capable of operating on the North Atlantic route.

It is always startling to me that development in aviation, improvements in performance, range, and speed, and in reliability take place at such a remarkable pace; and that something which today seems quite revolutionary and novel is overtaken by something even more advanced in a very short space of time. In fact one tends to forget that the history of powered flight, from the first flight of the Wright Brothers to the high speed, long range, jet aeroplane of today, is all crammed into the very short space of 52 years. This is a fact which tends to be overlooked, and to illustrate the point pictorially I would like to show you a chart which lists some of the better known long distance record breaking flights carried out between

NOTABLE LONG DISTANCE FLIGHTS 1919–1953

Date	Crew	Route	Distance	Time	Speed
1919	Alcock and Brown ...	St. Johns, Newfoundland–Clifden, Co. Galway (non-stop)	(s. miles) 1,950	16 hrs. 12 mins.	(m.p.h.) 120
1927	Charles Lindbergh ...	New York–Paris (non-stop).	3,610	33 hrs. 30 mins.	107
1933	Gayford and Nicholetts	Cranwell–Walvis Bay (non-stop).	5,309	48 hrs. 16 mins.	110
1934	Scott and Campbell Black	Mildenhall–Melbourne (five stops).	9,500	71 hours	158
1938	Kellet and R.A.F. crews	Ismailia–Darwin (non-stop).	7,158	41 hours	150
1946	Davies	Perth–Columbus, Ohio (non-stop).	11,236	55 hrs. 10 mins.	202
1953	Burton and Gannon ...	London-Christchurch, N.Z. (four stops)	11,000	23 hrs. 51 mins.	494

the period after the 1914–18 War and the present day. These range from the first Atlantic crossing in 1919 by Alcock and Brown at a speed of 120 m.p.h. to the New Zealand flight in 1953 by Burton and Gannon at 492 m.p.h. You can see from this that over a period of only 34 years speeds have increased fourfold. You will also note the very long ranges obtained with the older piston engined aircraft; for example the flight in 1938 from Ismailia to Darwin—7,000 miles. Now with the introduction of the jet engine, although a great advance in speed was made, the long range capability was temporarily lost due to extremely high fuel consumptions and to the fact that the early jet aircraft built were of the fighter and light bomber type and did not carry very large fuel loads. However, we are now getting to the stage where very large jet aircraft are being built capable of carrying the big fuel loads required for long range, and we shall be capable of flying very long distances and of course at very much greater speeds.

I do particularly want to stress this fact, the fact that progress in aviation has taken place and is still taking place at a tremendous pace, because it means that those of us whose profession is in aviation find ourselves continually faced with completely new problems every day. No sooner have we worked out the method and technique required for one type of flying than we are faced with some quite new problems which require a new approach, new ideas, and new methods of training and operation.

It is some of these problems in connection with long range flying that I want to discuss this afternoon ; problems with which we are now faced with the introduction of the new ' V ' class aircraft. I am concerned with the problem of converting the crews in Bomber Command to the Valiant, and it is from the purely practical point of view that I propose to tackle the subject. Furthermore, as a serving officer, I shall speak with a military bias—because our requirements are slightly different from those in the field of civil aviation. Nevertheless, whether you are dealing with military or civil long range jet aircraft, the same broad principles apply.

I propose to discuss the subject under the following headings :—

1. Performance—range and speed.
2. Navigation.
3. Weather forecasting for long range high speed flying.
4. Human factors—endurance and fatigue.

Range and Speed

When planning a long distance flight, the overriding consideration is quite clearly the range capability of the aircraft in question, and in the planning of the route for the New Zealand air race this was the first thing we had to decide, since the range factor governed the selection of the stops en route.

Now with the jet engine, the fuel consumption at low altitude is very high. With increase in height, however, fuel consumption becomes less, and to get maximum economy of fuel, flights with jet aircraft must be carried out at very high altitude—that is to say, at heights of 40,000 to 50,000 ft. in order to get maximum range. I don't propose to go into the detailed reasons for this economy in fuel consumption with increase in altitude in this lecture, but the main factors are, of course, the reduction in air density with increase in height and the changes in temperature.

Temperature is a very important factor. One of the properties of the atmosphere is that temperature decreases with height up to the tropopause, that is to say, the boundary separating the troposphere from the stratosphere. In the troposphere there is a temperature lapse rate, temperature decreasing with height. In the stratosphere, however, temperature ceases to fall off as height is gained and remains fairly constant. In the diagram I have shown the tropopause being at 40,000 ft., which is fairly typical of conditions in temperate latitudes. The actual height of the tropopause will of course vary daily. In the tropics the tropopause is very high, up to 60,000 ft. or above, and in the polar regions in the neighbourhood of 20,000 ft. This means that, contrary to what one would expect, much lower temperatures are encountered in the upper atmosphere in the tropics than are encountered in temperate zones.

Now temperature, as I say, has a big bearing on engine efficiency. As temperature decreases as we climb, it means that the thermal efficiency of the jet engine becomes greater, since the temperature difference between the air being

sucked in or forced in at the front of the engine, and the air being expelled at the rear of the jet pipe and imparting thrust, is greater. As altitude is increased, then, in the troposphere, this temperature rise through the engine is greater and the engine is more efficient.

The first conclusion we arrive at, therefore, is that for maximum range we must fly as high as possible.

I would next like to consider the cruise technique which we adopt with long range jet aeroplanes. Starting from the take-off, since the fuel consumption at low altitude is very high, we must climb to height as quickly as possible, spending the very minimum time in the lower height bands. We therefore climb at a high power setting.

Immediately after take-off an aircraft with a heavy fuel load will be at a high weight, in fact not far short of its maximum take-off weight. The excess lift over the weight required to make the aircraft climb is produced by the thrust developed by the engines operating at high power. The engine power available for the climb falls off as height is gained, and a time will come when there will be insufficient thrust available to enable the aircraft to climb any more at that particular weight. In fact there is a definite limit to the height that can be reached on the initial climb, and this can be calculated and, in fact, is part of the pre-flight planning.

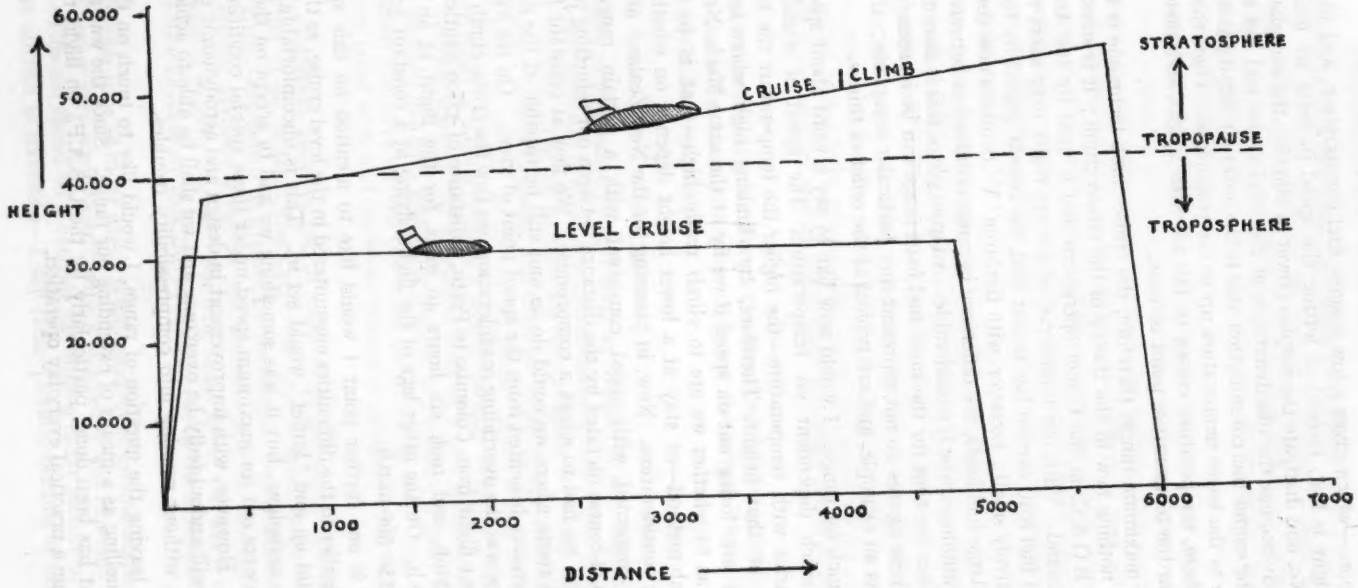
So far so good—we have now climbed up and reached our maximum possible height immediately after take-off. From now on we have a choice, either we can cruise at a constant altitude, or alternatively we can allow the aeroplane to climb higher as weight is lost. These two cases are illustrated in the diagram showing the flight profiles.

First of all let us consider the cruise at constant height. The cruise is started, let us say, at 30,000 ft. As fuel is used and the weight of the aircraft is reduced, less power from the engines is required to maintain constant height at a constant speed. Therefore it would seem at first sight that a reduction in engine power is required. This, however, is not desirable because a jet engine is most efficient at a high power setting—as power is reduced a point is reached at which the specific fuel consumption goes up. It is desirable therefore to maintain a fairly high power setting on the engine at all times. If this is done and the aircraft is maintained in level flight, the surplus thrust must be absorbed somewhere—it is in fact converted into speed. Our speed therefore increases. This fact may lead eventually to difficulties in that our speed will start to approach the speed of sound, and as Mach. No. is increased the aircraft will tend to buffet—that is to say judder or vibrate excessively—as compressibility effects begin to be felt. The aircraft will therefore become uncomfortable to fly, and if the buffet becomes too severe damage to the structure can result.

In adopting the constant height cruise technique for the maximum range case we are therefore in rather a dilemma. If we reduce power by throttling the engines, we lose out on engine efficiency and range is reduced. Alternatively, if we maintain the power, the speed will rise until compressibility effects are felt. We must therefore look elsewhere for the solution to the problem.

Another technique which has been developed is known as the cruise climb technique, and this has been devised to overcome the shortcomings of the level cruise. What we do in this case is to maintain a constant power setting on the engines—

FLIGHT PROFILES



high r.p.m.—which gives a low specific fuel consumption, and then as fuel is used and weight is lost, instead of letting the speed increase we maintain a constant Mach. No. and dissipate the surplus power in allowing the aeroplane to climb. This system overcomes the disadvantages of the level cruise and has the advantage of improving engine fuel consumption, due to the lower air density as height is increased, and due to the lower temperature up to the tropopause. Once the aircraft is in the stratosphere, temperature ceases to fall off with height and therefore there is no gain from the temperature point of view.

For maximum range, therefore, the cruise climb technique is the one to adopt. There is nothing new in the theory of the cruise climb ; it is something which was used by B.O.A.C. in the Comet operations and is used by the American Strategic Air Command. With our Canberras, which are really only short range aeroplanes, the small fuel load carried has meant that the benefit gained by the cruise climb is comparatively small ; however, with the large ' V ' bombers now coming into service carrying large fuel loads, the difference in range obtained as between the level cruise and the climbing cruise is considerable. An example of this is shown on the diagram, and you can see that for the same fuel load range can be increased by about 1,000 miles. These figures do not represent any particular aeroplane ; they are designed to serve as an example, and are typical of the order of things.

So much for range. I would now like to say a word about speed. Now speed is very much dependent on temperature. The speed of sound at any given height varies with temperature—the higher the temperature the higher the speed of sound at that height. Therefore, by climbing high where temperatures are lower, we are losing out on speed if we fly at the same Mach. No. The decision therefore as to whether we are to climb really high—that is to say, adopt the cruise climb method—or stay at a lower height depends on whether speed is the overriding consideration. Now, in planning for the New Zealand air race we were primarily concerned with speed consistent with a certain range requirement, which was of course dictated by the distance between our refuelling points. And so, for the race, we had to adopt a compromise. We flew at constant height on those legs of the route where we could do so and still be capable of the necessary range, and we therefore benefited from the speed point of view. On the very long stages, where range was the overriding consideration, we flew the cruise climb ; for example, on the direct flight from Colombo to Perth, a distance of 3,600 nautical miles, I flew a cruise climb, and took six hours 40 mins. for the flight, at an average speed of 540 m.p.h. On the other legs of the flight, flying at a constant 30,000 ft., I was averaging 550–560 m.p.h.

There is one further point I would like to mention on this speed question. I referred earlier to the difficulties encountered in the level cruise, as the speed would tend to build up and ' buffet ' would set in. This is uncomfortable and of course bad for the aeroplane, but it was something we had to accept on the New Zealand flight as we were out for maximum speed under these special conditions, i.e., racing conditions. However, with improvement in design and aerodynamic qualities, these difficulties will undoubtedly be overcome and we shall be able to achieve the higher Mach. Nos. without running into compressibility troubles.

Before leaving the question of range, I would like to touch on the problem of in-flight refuelling as a means of extending our range. Since the war a great deal of development has been done, particularly by the U.S.A.F., on flight refuelling, and it has become a practical everyday operation.

What are the advantages to be gained by flight refuelling?

(*a*) Firstly it means that bombers, for example, operating from a main base can be topped up with fuel by tankers positioned at advanced bases. This flight refuelling can take place on the outward and return flight, and thus overall range can be extended.

(*b*) Again from the military point of view, greater flexibility is possible. For example, it so often happened in the last war that operations had to be cancelled because of a forecast of bad weather over bases in this Country on return, and with insufficient fuel no long range diversion to a base with good weather was possible. Now with flight refuelling, bombers could be launched in the face of possible fog on return, and in this case they could be diverted to, say, North Africa or the Middle East and refuelled in the air by tankers operating from bases in these areas.

(*c*) Thirdly, there is the question of the very high weight of the long range aircraft at take-off, and the physical difficulty of getting very big aeroplanes off the ground, particularly in tropical conditions where very long runways are required. Now with flight refuelling, a take-off can be made at a lighter and safer weight; once airborne the aeroplane can be topped up to its maximum load, which would probably be greater than could be hauled off the ground at take-off. This is yet another way in which flight refuelling seems to offer some advantage.

I think we have a great deal to learn from the Americans in this question of flight refuelling, not so much the basic principles of it, but the actual "know-how" of carrying out flight refuelling operations.

Navigation

The next aspect of long range flying I want to consider is the vital question of navigation. The great increases in speed now attainable have meant that new methods of navigation are required. The big problem for the navigator is to keep up with the progress of the aircraft over the ground, and therefore to be in a position to take the correct action to keep the aircraft on the correct track. When we are moving along at a speed of eight miles or more a minute, it is only too easy to get left behind, so to speak, and find yourself working out a problem such as a new wind velocity, when by the time the problem has been solved the aircraft is 100 miles or more further on, and the information you have worked out is not much use to you. This is the sort of difficulty we are faced with, and the whole process of navigation has to be speeded up.

Now what equipment have we got to assist us in the navigation of these jet aeroplanes? First of all, radar. The Canberras have a short range radar fixing aid—known as GEE—dependent on ground transmissions. One is therefore entirely dependent on ground stations which at the moment provide coverage over this Country and parts of western Europe. For long range flying this aid is no use, and on our flight to New Zealand we took this equipment out of the aeroplanes to reduce weight.

There is another type of radar which is independent of ground stations; this is known as H2S and is very much more complex and heavy and can only be fitted to large aircraft. This aid shows on a cathode ray tube a radar picture of the ground over which the aircraft is travelling—I say radar picture, because it needs a lot of

training and practice to be able to interpret it correctly. Good results can be obtained over terrain where there are towns, rivers, and coastlines, in fact a contrast which shows up on the tube. Over featureless country it is not much help, and of course over the sea it is no use at all.

The next thing we have is radio fixing by means of radio compass bearings using a loop aerial. This is an old fashioned and well tried method, but it is still a most useful aid, particularly where more elaborate equipment cannot be carried. For example, in the Canberra, where there is not much room, the radio compass is most useful for long range flying—we used it with great success on the New Zealand air race—it was in fact our primary fixing aid. It has limitations and weaknesses, but with plenty of practice and experience extremely good results can be obtained. It also has the disadvantage that the frequencies used in radio compass work are easily jammable in wartime; this would probably apply particularly in western Europe. Nevertheless there are many parts of the world where, even in wartime, the radio compass would be very valuable, and in peacetime, for the long range flights we are called upon to undertake from time to time, it is essential.

The third method of navigation I want to mention is fixing by astronomical observation. This method of fixing position has, in my opinion, really come to the fore with the advent of the high flying jet aircraft, because generally speaking one is flying above the weather, and therefore there is no cloud to obscure the sun, moon, or stars, which was always the trouble when at medium altitudes. Furthermore, the jet aeroplane is fairly free from vibration, and provides a steady platform from which astro shots can be taken.

The advent of the periscopic sextant which is now in use is a great advance over the older hand-held version. Much greater accuracy is obtainable, and by pre-computation of azimuth and altitude, the figures can be set on the sextant and the star required will, or should, be readily visible in the telescope—thus doing away with the need for star recognition, which considerably reduces the training problem.

In the Service, I think we have got to pay very much more attention to astro navigation in the future. Previously, astro has been unpopular mainly because of the inaccuracies due to the extreme awkwardness of taking sights in most aeroplanes, particularly with the hand-held sextant, and the unsuitable platform which the older piston engined aircraft provided. Also, the time taken in the reduction of sights was too long. However, with the new tables now available and by precomputation, the whole process can be speeded up. Astro, moreover, is independent of all the other electronic navigation aids, and as long as you have a light to illuminate the bubble in the sextant you still have a first-class fixing aid, even if everything else has gone wrong. In the new jet bombers we are planning to make much more use of astro than we have in the past.

To sum up, then, we have to help us in our navigation, radar, radio bearings, and astro. These aids produce the information which can be applied to the normal dead reckoning plot which we must of course keep. There is no short cut to this.

To speed up the process of navigation, however, we try to reduce the amount of logging in the navigator's log to the very minimum, and keep most of the work on the chart. By very elaborate and detailed pre-flight planning and by precomputing our astro, we can save a great deal of time in the air. Of course, thorough training and continual practice are essential.

Meteorology

Following on the problem of navigation, I would like to turn to the question of weather forecasting for long range jet flying. High altitude high speed flight has made big demands on the weather forecasting service. In addition to all the general weather information we require—pressure distribution, position of frontal systems, and so on—we also need upper air information, particularly wind velocities at high altitude, and temperatures. This means that an elaborate network of stations is needed to obtain and distribute information of the upper atmosphere by the radio or radar sonde system. This consists of special equipment designed to read temperature and humidity, which is carried up to a very high altitude by balloon and the information transmitted automatically to the ground station. These stations are costly to equip and run, but are essential if adequate coverage is to be provided to enable the weather information to be available to us. As I said at the beginning of this lecture in connection with aircraft performance, temperature plays a most significant part in range considerations, and therefore, for accurate flight planning, a reliable estimate of temperature is essential. If forecast temperatures are greatly at variance with actual conditions, then planned performance will be in error and may affect the range obtainable.

At high altitude very strong wind velocities can occur, known as jet streams. These are narrow belts of very high winds varying in strength from 100 knots to 200 knots and, without upper air ascents, are very difficult to forecast. The whole question of jet streams is something on which a great deal of study has been done, but there is still a lot to learn. Jet streams are to some extent seasonal, and in certain parts of the world can be forecast with reasonable accuracy. For example, in Australia there is in October–November a powerful core of strong winds running from the vicinity of Perth roughly along the south coast of the Australian continent. Knowledge of such jet streams can be most valuable in planning long range flights, and in fact we planned to make use of this particular jet stream in our flight to New Zealand. Unfortunately, at the time we were there, it was not up to its full strength, and so we did not get the high ground speeds we hoped for. I think the wind was, in fact, well below 100 knots in strength at the time we were flying on that stage of the route.

It is easy to see that accurate knowledge of these strong winds is all important. If you are faced suddenly with an unforecast head wind of jet stream strength, the consequences of lack of knowledge about it, particularly in parts of the world where facilities and airfields are few and far between, can be very serious.

Another thing I want to mention is that of turbulence, which occurs at high altitudes very often in clear air, and therefore when you are not expecting it. This is a phenomenon which is not yet understood. It is known that such turbulence can be associated with a jet stream and is often encountered on the edges of the jet stream. It is therefore important that areas of clear air turbulence should be forecast so that height bands can be selected for cruising to avoid violent turbulence and discomfort.

With jet aircraft flying at great height we have the advantage of being able to cruise at high altitude generally above the weather. This certainly applies in temperate latitudes; in the tropics, however, the weather does extend higher due to the higher tropopause, and cloud is known to extend to 50,000 and 60,000 ft. Generally speaking, though, we cruise above the weather.

For take-off and landing, however, we still have the ordinary problems to contend with, the physical business of being able to get the aircraft to a position from which a visual landing can be made in conditions of bad visibility. Although we have various approach aids to get you into a landing position, the last bit still has to be done visually. In bad weather it tends to be more difficult in jet aircraft due to the higher speeds, and of course the very high fuel consumption at low altitude means that we cannot afford to hang about airports low down trying to land in poor weather. In fact we must stay at altitude if there is any time wasting to do. Once we are committed to the descent, we must land. Therefore if a diversion to another base is necessary, due to bad weather, a decision must generally be made before the aircraft descends, unless, of course, a very large fuel reserve is carried.

I think you can see, then, that with jet flying the need for accurate weather forecasting is paramount ; mistakes can have very serious consequences.

Having, with jet aircraft, got above the weather, into the clear so to speak, we have now run into problems associated with the upper atmosphere, jet streams and clear air turbulence, two problems on which we still have a great deal to learn.

The Crew—Human Factors

The last subject I want to touch on is that concerning the crew of the aeroplane, problems effecting crew efficiency with high altitude flying and methods of combating fatigue.

Now with the older types of piston engine aeroplane one of the major causes of fatigue was noise and vibration; with jet aircraft this problem has been largely overcome. The jet aeroplane is almost free from vibration, certainly engine vibration which was the trouble with the piston engine aircraft, and the only vibration encountered in aircraft of the Canberra and Valiant type should be due to aerodynamic reasons, the airframe buffet at high Mach. Nos. due to compressibility effects. As for noise, jet aeroplanes, although very noisy on the ground or to anyone outside, are in fact comparatively noise-free in the cabin ; and of course pressurization of the cabin helps this as the cabins are sealed. And so, from the point of view of noise and vibration, we are better off.

High altitude flight means that oxygen is required for breathing—this is another cause of fatigue. The atmosphere consists of roughly four-fifths nitrogen and one-fifth oxygen. At sea level, the oxygen pressure is about 200 millibars, and at 40,000 ft. this pressure is down to roughly 40 millibars. The deficiency has to be made up, and in modern aircraft this is done by pressurizing the cabin by drawing air from the engine compressors. In civil aircraft the cabin is fully pressurized, and oxygen is not normally required for passengers. In military aircraft, however, oxygen is still required as well as the pressure cabin, since it is necessary to guard against rupturing of the cabin due to enemy action, shells and so on. Oxygen masks are, of course, worn the whole time. At heights of about 50,000 ft. in the event of a failure of the pressurization of the cabin, one breathes pure oxygen under slight pressure through the mask and this is enough to keep you alive for a very short time, enough to enable you to get the aircraft down to a safe height below 40,000 feet where you can exist on ordinary oxygen breathing. Above this height without a pressure cabin, oxygen alone is not enough. We have got to the stage now where we are going still higher above 50,000 feet, probably to 60 and 70,000 feet during the next five to ten years. Now, at heights above 50,000 feet a failure of the pressure cabin due to enemy action, for example, would be most serious, as one might not remain

conscious long enough to bring the aircraft down to a safe height even when breathing oxygen under pressure. We therefore say that 50,000 feet is the limit we can go to with the normal pressure cabin, and above this height we must wear pressure suits; that is to say an individual pressure cabin for each member of the crew, which in the event of cabin failure provides the necessary counter-pressure against the body. As you can imagine the suits have to be a perfect fit to be able to hold the pressure, and in addition a special pressure helmet is required. All this is most uncomfortable and just adds to the general discomfort and fatigue of high altitude flight. There are, broadly speaking, two types of pressure suit, the partial pressure suit and the full pressure suit. The former does not provide any protection over the hands and feet, and this means that one can suffer from ' bends ', ' bends ' being acute pains which occur at the joints at extreme altitudes. The full pressure suit, however, which encloses the whole body, overcomes this difficulty. Full pressure suits tend to be rather cumbersome—they are not new, they were made before the last war for the height record flights carried out in the 1930's and the whole equipment looked rather like a diver's suit. Quite clearly this sort of thing would be unsatisfactory and very fatiguing if it had to be worn for very long periods and the whole question of pressure suits is a difficult one, and we are still a good way from a satisfactory solution.

One final point in connection with fatigue, the question of feeding in the air in military aircraft. The provision of suitable food and drink plays an important part in combating fatigue. When we are flying for ten hours or more at high altitude, which we will be doing as a matter of routine, some food is required. It depends very much on the individual taste as to what is it. But elaborate food is out of the question. In the Canberras with the two-man crew we had in the air race, feeding in the air was very difficult, and in fact we had what little food we took during the 24 hours period at the stops en route. We had about 15–20 minutes on the ground except in the cases where some technical defect occurred, and pre-arranged snacks were passed up to us in the cockpit as, of course, there was not time to get out. This was not a very satisfactory arrangement. We also had flasks of hot beverages and fruit juices with us, but it was all rather primitive.

There is, I feel, scope for improvement here, and I think it is generally agreed that more can be done on this particular problem to help in reducing fatigue. It is all these small things which add up and make all the difference, and if we can improve on the small things greater crew efficiency will result.

Conclusion

In this short survey of some of the problems we have to contend with in high altitude high speed flight, I have tried to touch on some of the most important factors ; I have glossed over a great many others. As I said at the beginning, with these new ' V ' class bombers we are entering a new and fascinating phase in long range high speed flight. I am concerned in it from the military point of view, but the points I have referred to apply equally to the civil operator, and I think performance of the military aircraft points the way to the sort of thing we are likely to see in air transport in the next five to ten years. Progress will undoubtedly be very rapid ; airliners flying at well over 500 m.p.h. and flying distances of 5,000–10,000 miles will be the order of the day.

As far as the military side goes, the importance of our having an effective long range bomber force as a deterrent to war and as our primary means of defence

is, I think, generally accepted. It is now our job in the Royal Air Force to weld this new 'V' bomber force into an effective fighting machine.

DISCUSSION

WING COMMANDER P. H. ROSCOE: Could the lecturer indicate the margin of error now experienced in astro-shots?

THE LECTURER: We used the periscopic sextant on the New Zealand flight mainly on sun shots, particularly between Colombo and Perth. The sort of error we estimated to be five to ten miles. I think that the main point about the periscopic sextant in a jet aeroplane is that you have a very good platform for taking astro shots. As I mentioned in the lecture, there is far less vibration in the jet aircraft than in the piston engine types, and there is no reason why you should not get fairly good results, particularly if you can take shots fore and aft. I admit that you get acceleration errors which give a larger overall error, but I think we can say that errors of ten miles are acceptable; if errors are consistently greater than this, then the value of astro will be considerably reduced.

I believe that we must make use of the sextant as much as possible because it is a navigation aid which is completely independent of all other devices. It is no good waiting until something else goes wrong and then saying, "We must do some astro-navigation." Unless you do it every day it is no use. It is necessary to have continual practice at it so that good results can be obtained in an emergency.

LIEUT.-COLONEL C. GARSIA: How much fuel would any given aeroplane consume, say, in 1,000 miles' flying at 1,000 feet and how much less at 50,000 feet? Secondly, would the lecturer explain how an aeroplane connects with a tanker for refuelling?

THE LECTURER: It is difficult to give the actual figures of fuel consumption for 1,000 miles of flying at the two heights you mention, but I can give you some idea of what happens in the case of the Canberra in terms of gallons per hour. Fuel consumption at ground level is something of the order of 1,000 gallons an hour, and at 50,000 feet, 300 gallons an hour. At 20,000 feet it is of the order of 600 gallons per hour. You can see, therefore, that there is a big difference between the ground level figure and the high altitude figure.

With regard to the second part of your question on the subject of flight refuelling, the first part of the problem is navigational, that is, in getting the two aeroplanes in the vicinity of each other. This is a navigational problem. It is necessary to make a rendezvous point, to navigate to within 20 miles of it, and then the final approach can be made by "homing" by radio or radar. Next comes the problem of actually connecting the refuelling hose from one aeroplane to another, and there are two main methods of doing that.

First of all there is the British system which is known as the "probe and drogue" system. In this system the tanker aircraft reels out behind it a flexible hose which has attached to it a drogue or funnel with the larger open end facing aft. The aircraft to be refuelled is fitted with a probe mounted on the nose or wing of the aircraft; the probe being rigid and projecting to about 10 feet or more in front of the aircraft.

To connect with the tanker the receiving aircraft flies in formation behind the tanker, and, with a very low overtaking speed, aims the probe into the funnel in the end of the refuelling hose. Once the connection is made, the probe is held in the funnel by spring toggles and the refuelling valve is open hydraulically. Fuel is then passed from the tanker to the receiving aircraft. When the refuelling operation is completed, the connecting hose is purged by passing nitrogen through the pipe lines. This is to reduce any danger of fire from sparking due to static when the disconnection takes place.

The other system is an American one known as the flying boom system, developed by the Boeing Company. The tanker aircraft has a boom about 20 feet long trailing from the rear, which is fitted with control surfaces and which can be manœuvred by one of the

crew in the tanker aeroplane. The aircraft to be refuelled flies up behind the tanker, and the operator in the tanker aircraft " flies " his boom into position relative to the refuelling nozzle in the receiver aircraft. A connector nozzle can then be extended from the boom to enable a connection to be made.

This is an operation which requires experience and training. The Americans have had a great deal of experience and practice at these refuelling operations, but we have a lot to learn, I think, in this particular field.

As a matter of interest I received this quarter's R.U.S.I. Journal last night and there is an article on flight refuelling contained in it. I was quite surprised when I read that article to find how much development work has in fact been done during the last 20 years or so on flight refuelling both here and in the United States. That article shows that some remarkable flights were carried out.

WING COMMANDER E. B. BEAUMAN: The lecturer told us that people can only live for a few seconds at over 50,000 feet if the pressurization goes wrong. I was wondering how he knows that? I ask this because there was a time when it was thought that human beings could not live over 16,000 feet without oxygen, then it was raised to 20,000 feet and now it is being found that people can live and walk at 28,000 feet without oxygen.

THE LECTURER: Of course I have not tried it. We are told by the doctors, and I think it is generally accepted, as a result of tests in decompression chambers, that at heights above 50,000 feet, it is literally only a matter of seconds before you begin to suffer from lack of oxygen even when breathing oxygen under pressure. You are likely to become unconscious in less than a minute. This is due to the fact that there is a certain amount of water vapour and carbon dioxide in your system at all times, and at extreme height the whole space in your lungs is taken up by the two gases, and there is, therefore, no room for any oxygen.

Without a pressure, suit, therefore, if we are to cater for possible pressure cabin failure, we must not fly higher than 50,000 feet. From 50,000 feet the pilot can remain conscious long enough, breathing oxygen under pressure, to get the aircraft down to a safe height; above 50,000 feet this would not apply. If, therefore, we are to operate above 50,000 feet we must wear pressure suits.

WING COMMANDER R. MILROY HAYES: Is the Delta type of " V " bomber likely to be less prone to vibration and buffeting?

THE LECTURER: I am afraid I cannot help you much on that question as I do not know a great deal about the Vulcan which I assume is the aircraft you are referring to. The Delta type is a later mark of aeroplane and all the time improvements in design are going on. I assume, therefore, that the Delta design will be better.

AIR COMMODORE R. H. VERNEY: With regard to the difficulty concerning pressure suits, I wonder whether it would be feasible to have very small pressure cabins in which two or three members of the crew could be together? It seems to me that the present suit must be very cumbersome and will make handling very difficult.

THE LECTURER: I have not actually worn a pressure suit on any long flight, but what I have seen of them leads me to believe that it would be a fairly uncomfortable business if you had to wear one for ten hours. A great deal of work is going on on this subject in order to produce a satisfactory answer.

You mention small pressure cabins. The Canberra has a fairly small pressure cabin, but it is a cramped aeroplane, and if you are to fly and to operate over long distances I think you must have reasonable room in which to work. Therefore, we are tending to go to rather larger pressure cabins to give more space for the crew to be able to work in comfortable surroundings and to make room for the extra equipment to be carried. I think that it would be difficult on large aeroplanes, in which a great deal of equipment has to be carried, to make the pressure cabin any smaller than it is already.

GROUP CAPTAIN H. E. C. BOXER: Referring to the lecturer's comment that he had his food passed up to him in the cockpit during the 15–20 minute stops and to his remark about the Canberra being a cramped aircraft, did he not find that sitting still for so long without getting out and stretching his legs became intolerably uncomfortable? Would he tell us something about the special training which was undertaken for the flight?

THE LECTURER: Well, of course, for this flight we did a great deal of training. When we were faced with this task of flying to New Zealand, we had not flown the Canberra over such long ranges before, and I think we felt that what was required was plenty of practice and the need to acclimatize ourselves to that type of flying. The training we did was really in three stages. We started off fairly gently by doing flights from England to Malta and back That was our first stage. We then extended it and went from. England to the Persian Gulf by day. Then, as the first stage of the air race was by night, leaving London at five o'clock in the afternoon, we carried out training by flying to the Persian Gulf at night so that we could simulate the actual conditions of the air race itself. This was particularly valuable from the navigational point of view, because we wanted to make use of the actual facilities which would be available at the time. The third stage was a flight out to Colombo and from Colombo to the Cocos Islands. Although for the actual race itself we had facilities at Cocos Islands, it was a complicated business getting fuel there, so for the training flights we were unable to land there. It was not possible to get enough fuel there for training flights and for the race itself, and so we flew to Colombo, refuelled, and then did the long flight from Colombo to a point within 200 miles of the Cocos Islands so that we could contact the control there, and talk with them on the radio, and satisfy ourselves that navigational facilities were adequate. We then returned to Colombo. Then we flew from Colombo to England. After that we had one final training flight which was a high speed dash to Colombo and straight back again, refuelling in the Persian Gulf and at Malta on the return journey. The distance covered on this flight was roughly the same as for the whole route to New Zealand.

Having done that, we felt fairly happy that we could sit in an aeroplane for 24 hours on end without any trouble. It was very cramped and a number of people asked us why we did not get out at the stops en route, but we found that it was quite a business getting in and out, particularly when wearing the life-saving waistcoat, pressure waistcoat, and a parachute. There were so many harnesses and buckles that it was found less fatiguing to stay in the aeroplane at stops. This applies particularly in the tropics. We arrived at Colombo, for example, at about 10 o'clock in the morning when the temperature was well up. We had come down from a high altitude and were in fact sitting in a cold aeroplane, and we were, therefore, better off than we would have been outside. We did in fact plan to stay in the aeroplane all the time, and the only occasions upon which we got out were when we were delayed, due to some technical trouble with the aeroplane, as in my case occurred at Perth. It meant that we had to have food passed up to us in the cockpit on normal stops, and with all the excitement of refuelling the aeroplane and the navigators being briefed, there was not much time to do justice to the meals which were provided.

CAPTAIN A. R. FARQUHAR, R.N.: The lecturer laid emphasis on the need for accurate astro-navigation. I should like to know whether the pressure suit enables one to have easy access to the sextant?

THE LECTURER: I do not personally know much about the full pressure suit. Under normal conditions the suit is not pressurised; it is only when the cabin fails that it becomes pressurised so that under normal conditions it would not be too bad, and in using the sextant, for example, you would not be able to have the helmet on. On arrival in a combat zone where there was a likelihood of damage being sustained, astro-navigation would be abandoned and pressure helmet would be on in readiness.

AIR COMMODORE K. B. B. CROSS: Were there any significant differences in the technique used by the Australians and those used by yourselves in navigation and other ways?

THE LECTURER: Very little actually. We selected the lowest altitude at which we could fly consistent with the range required for any particular leg of the route and then took into account the wind velocities at the various heights. We found, generally speaking, that 35,000 feet was about the fastest height band. The Australians changed their height frequently in flight, according to the temperatures. They studied temperatures in great detail, and kept chopping heights up and down to make the best use of the temperatures. It was a complicated technique and, as it turned out, it did not make much difference. The interesting point about it was that for the three Royal Air Force Canberras and the two Australian Canberras in the speed section, the actual flying times on the race—not counting the time spent on the ground which, of course, varied tremendously in each case—were all within a bracket of nine minutes. The fastest aircraft took 22 hours, 22 minutes, and the slowest 22 hours, 31 minutes. This seems quite remarkable over that long distance. Therefore, techniques did not make a great deal of difference.

When we went into it all afterwards, we felt that their methods were rather complicated. Although in theory they were, perhaps, the best, in practice they were not really worth it.

THE CHAIRMAN: I should like first of all not to try to sum up, because that has already been done very clearly by Wing Commander Hodges, but to refer to one or two points he has mentioned.

A new phase in flying has arrived, and some new difficulties have come along because in modern Service aircraft a stage of progress has been missed out. Sir Frank Whittle's design of the original gas turbine was the optimum stage. The turbine-propeller stage which would have built us up steadily only came later. After the big leap forward which has taken place, with its problems, civil aircraft such as the Viscount and the Britannia, with turbo-props, have adopted this intermediate stage. The many problems which this leap forward has brought to the Service pilot and the navigator we have heard about very clearly this afternoon. The human machine cannot adapt itself very quickly to these matters of time and space. Long distance high speed flying must depend upon careful pre-flight planning. All the arrangements must be made before leaving the ground, and one of the things which is most important is the weather forecast. The lecturer mentioned the jet stream. One has to be prepared for wind speeds of 100 to 200 miles per hour in this jet stream, and one of the Comets on its way to Japan actually encountered one jet stream of 400 miles per hour. The Americans and B.O.A.C. are beginning to learn more about it and occasionally can make good use of it, cutting down by several hours high speed, high altitude flights across the Atlantic and Pacific.

With regard to navigational difficulties, the lecturer pointed out that these were being overcome by astro-navigation. That was of great interest to all those who have had anything to do with navigation and long range flying.

On your behalf I thank the lecturer for his address which has been of very great interest to us all. (*Applause.*)

ROCKET PROPULSION AND ITS IMPLICATIONS TO HUMAN SOCIETY

By Mr. A. V. CLEAVER, F.R.Ae.S.

On Wednesday, 23rd February, 1955, at 3 p.m.

LIEUT.-GENERAL SIR JOHN ELDRIDGE, K.B.E., C.B., D.S.O., M.C.,
in the Chair

THE CHAIRMAN: It is my privilege to introduce to you this afternoon Mr. Cleaver who will talk to us about rocket propulsion and its implications to human society.

Mr. Cleaver is a Fellow of the Royal Aeronautical Society and he is at present engaged in the design and development of liquid propellent rocket engines. He is a member of the Interplanetary Society, of which he has been Chairman, and I cannot think of anyone better qualified to address us on the subject.

LECTURE

THE title of this talk was suggested by the Royal United Service Institution itself. When invited to give it, my first reaction was to feel deeply honoured at having been asked at all, but this was quickly followed by some anxiety as to exactly what was expected of me.

It seemed more than likely that such a body as yours would hope to hear, in the main, a discussion of the future role of the rocket in military affairs, but while this subject is very important, very topical, and very interesting, there were three good reasons why I preferred not to adopt that treatment, and in fact have not done so.

In the first place, it would perhaps have been too topical, and too interesting to an audience other than the intended one. Secondly, while I might possibly have been able to expound on some technical aspects of the matter, I hardly felt qualified to lecture to you at length on the tactical and strategical implications of it. However, the third reason, and the most important of all, was that I did not consider these implications, in the long run, to be the most significant ones.

I hope to be able to persuade you of this possibility; if you feel that my qualifications do not extend to this field either, I can plead that it is one in which there are as yet no professionals, so that the views of an amateur have at least a chance of being worth a hearing. And, of course, I shall touch on the more immediate questions with which your organization may have thought I should principally concern myself, for the whole must contain its parts.

Suppose, for a moment, that someone, a century and a half ago, had been invited to talk on "Steam Power and its Implications to Human Society"; I have chosen to regard my present assignment in a somewhat analogous light. This imaginary lecturer of the reign of George III might have decided to concentrate on the large and very important effects of the coming replacement of sail by steam in the Royal Navy, with all its implications to the British Empire, and to world strategy and politics generally. On the other hand, in a spirit of greater daring (or greater foolhardiness), he might have ventured to include a discussion of the even larger and more important effects of steam power, which seemed probable to him, in the whole field of commerce, transport, and civilization. In that event, if he had been a sound prophet, he would have needed to give at least a hint, not only of the coming age of

railways and steamships and the industrial revolution, but also of the entire range of technologies which might develop in consequence, and of the far-reaching changes in the outlook and mode of life of everyone on this planet which would result.

Because I believe that rocket propulsion, in a rather different way (for history never *exactly* repeats itself), has nevertheless a similarly immense potential influence, I have elected to adopt a similarly ambitious treatment of the subject on which you have asked me to talk.

Rocket Propulsion

It would be as well to define at the outset just what we mean by rocket propulsion. All self-propelled vehicles which have left the Earth's surface employ some form of reaction propulsion. That is to say, they generate their forward propulsive thrust from the reaction created by throwing backwards a mass of working fluid, just as a gun recoils against its firing point because of the shot and the propellent gases expelled in the opposite direction. This is equally true of the airscrew, the helicopter rotor, and the turbo-jet; all act on the atmospheric air in such a way that a certain mass of it is accelerated rearwards. (Lift, of course, is simply vertical thrust, so that the same phenomena occur in its production, whether by fixed wing, helicopter rotor, jet-lift, or rocket).

The rocket power plant belongs to this same family of reaction propulsion devices, but with a most important and significant difference. By definition, a rocket propulsion system is one which carries along, within the vehicle being propelled, *all the material necessary to provide its propulsive jet.*

Thus, a turbo-jet vehicle carries fuel as a source of energy, but relies on oxygen obtained from the atmosphere to burn with it, and so release its energy; atmospheric air provides the bulk of its propulsive jet. A rocket, on the other hand, is self-sufficient in reactive chemicals, and the whole mass of its exhaust initially belongs to the vehicle. It may, for example, carry as its propellents a fuel (such as alcohol, petrol, or paraffin) together with an oxidant (such as liquid oxygen, concentrated hydrogen peroxide, or nitric acid); the products of combustion of these chemicals provide all the reaction mass of the rocket exhaust jet.

The consequence of this essential difference is that, whereas the turbo-jet or any other air-breathing engine can produce a thrust only directly proportional to the density of the ambient air, a rocket propulsion system can provide thrust independently of its environment. A rocket engine, in fact, actually produces a slightly higher thrust when exhausting into a vacuum than it does at sea level: this is due to the reduction in back pressure on its propulsive nozzle.

Besides this fundamental characteristic, rocket engines have another very important secondary quality. Because of their essential simplicity, and the fact that they normally employ working fluids of great energy and high density, at high pressures and temperatures, they can deliver very large thrusts from a small size and weight of apparatus. This is important for all rocket applications, but it also makes the rocket engine suitable even for some for which it is not really very efficient, in the strict sense of conversion of available energy into useful work. A rocket engine is always a reasonably efficient converter of available chemical energy into kinetic energy of its very high velocity propulsive jet, but it is only under conditions of very fast flight at great altitudes that this jet is itself an efficient means of propulsion. There are some applications, however (e.g., the take-off assistance of aircraft), in

which the convenient ability of a small, light, rocket engine to generate high thrusts for relatively short periods outweighs its handicap of a high fluid consumption, which in turn results from its need to carry its own source of oxygen, as well as fuel.

Everyone is familiar with the simple solid propellent rocket, in which the fuel and oxidant are combined in some solid mixture or compound, such as gunpowder or cordite. The more modern development of liquid propellent rockets has introduced much greater possibilities, since this type is lighter for long burning times, can use more powerful propellents, and is capable of giving a controllable thrust output and of repeated stops and re-starts. Its propellents may be carried separately as a fuel and oxidant, or as a single mono-propellent; indeed, any chemicals capable of reacting with the release of energy and gaseous products can form the basis of a rocket system. (Hydrogen burned with fluorine would produce the highest performance of all the naturally available materials, though with some unpleasant problems of logistics and handling.)

However, it should be realized that on the broadest long-term view, rocket propulsion can (and almost certainly will) eventually include various types of power plant beyond any of those mentioned so far, all of which utilize chemical energy.

Out in space, solar energy might be employed to heat an inert working fluid (even water) to generate hot gases for expansion through a propulsive nozzle. More probably, nuclear energy might be applied in a similar way; alternatively, the atomic power might be used to generate an electrical potential, which could then be used to accelerate a propulsive jet or beam of charged particles, or perhaps this might be produced directly from some nuclear reaction. All such systems would logically fall within the accepted definition of rocket propulsion, and some of them will very probably find most important eventual uses in the wider application of rocket flight.

The rocket is, indeed, the only practical means which we know for travelling beyond the confines of any ambient medium (in particular, for flight beyond the Earth's atmosphere), because of its complete independence of its environment. The only conceivable alternative to it would be some device for directly manipulating gravitational fields; if such a thing is ever invented, as a result of new scientific discoveries, then everything which is said here about rocket propulsion will apply equally to it also.

The Past

The rocket is a quite ancient invention. It was in use in Asia many centuries ago, first as a firework and then as a primitive weapon of war. These Oriental 'fire-arrows' were adopted by the European colonizing nations and improved to the extent that Sir William Congreve's bombardment rockets were regarded as an important weapon of the British Army in the early XIXth Century. Superseded in turn by the development of more accurate long range guns, the rocket relapsed for a time into being a toy, to be brought out of retirement on 5th November or 4th July. It retained some practical uses for signalling and life saving, in both Service and civilian life, but was certainly never thought of as having any large potential for influencing human society or anything else.

Then, about the turn of the century, a number of pioneers recognized in the rocket a potential means of realizing an almost equally ancient dream, that of travelling to other worlds than the one which man has known as his home ever since his first evolution from the lower animals. During the first third of this XXth Century, men such as Goddard in America, Esnault-Pelterie (also a great pioneer of

aviation) in France, and Oberth in Germany, and many others, laid the foundations of the science of space flight, which has since become known as astronautics. As a result of their work, a number of small amateur societies began, in the nineteen twenties and thirties, to experiment with rockets once again, in a genuine spirit of scientific enquiry. In particular, these people began to develop the liquid propellent rocket, albeit in a crude form and on a very small scale, since their resources were extremely limited. Some of them were also conscious of the more immediate applications of rocket propulsion, in aviation and for bombardment weapons of even the greatest range, but in almost all cases the main motive of this rocket renaissance was an interest in the possibility of space travel.

The hard-headed German *Wehrmacht*, especially after the rise to power of the Nazis, undoubtedly took a greater interest in the more immediate potentialities of rocket propulsion. They gave facilities to such men as Dornberger and von Braun (the latter having been one of the more devoted and youthful members of the pre-war German interplanetary society) which resulted in the development of the V2 and a whole range of other rocket weapons. Rocket assistance was also used for heavy bombers and for the propulsion of high performance interceptor aircraft like the Me.163. It is no exaggeration to say that it was the Germans, between 1933 and 1945, who first established rocketry as a sound branch of modern technology and demonstrated its important applications. By the end of the 1939–45 War, they were seriously considering projects for trans-Atlantic rocket missiles and long-range piloted rocket aircraft.

By way of contrast to our great work on radar, jet propulsion, and atomic energy, we in Britain had done relatively little in the field of rocketry by that time, beyond producing a number of short-range solid-propellent rocket weapons. There were, of course, some quite sound military reasons for this; few of the applications of rocketry to warfare which were practicable at the time would have been of equal use to us as to our enemies, whose war situation was quite different. Not a great deal more had been achieved in the United States, although some work on liquid-propellent rocket propulsion, for both missiles and aircraft, had been carried out there. In 1945, however, the full impact of the German effort was felt as the results of the Allied interrogation teams began to become available.

The Present

Since the war, there have been a great many outward and visible signs that the German lead in applying rocket propulsion to guided missiles and aircraft has been energetically followed in various countries, not least (one might with fair certainty suspect) in the U.S.S.R. Another reasonable guess would be that the work actually in progress extends far beyond the scope of available published information, but even this reveals that the last decade has seen further strides in rocket performance.

The Americans have two piloted rocket-propelled research aircraft, the Bell X-1 and the Douglas D-558-2 Skyrocket, which have flown at speeds exceeding Mach 2 (say, about 1,500 m.p.h.), and at altitudes of over 15 miles. They have announced the forthcoming trials of a third, the Bell X-2, of even higher potential performance, and also a whole range of rocket missiles. These include the Terrier, Sparrow, Nike, Corporal, and the large Redstone, the latter being a project for the U.S. Army from the same group of German scientists and engineers, led by von Braun, which was responsible for the V2. Another considerable field of post-war rocket activity in the States has been a high-altitude research programme in which unmanned rockets have

been used to gather data on cosmic radiation and other physical and meteorological phenomena in the extreme upper atmosphere. In the course of this work, a Martin "Viking" rocket has ascended to a vertical height of 158 miles, while a two-stage combination of a V2 lower component and a small "WAC-Corporal" has reached 242 miles. Also, monkeys and mice have been successfully shot to a height of over 60 miles, and been safely recovered using specially-instrumented Aerobee rockets.

The French also have a rocket named Veronique for upper atmospheric research, and have demonstrated a piloted rocket-propelled interceptor aircraft, called the S.O.9000, or Trident. Some information has been released[1] on British rocket test vehicles and guided missiles, of the air-to-air and ground-to-air varieties, while the Swiss Oerlikon concern has also announced a rocket of the latter type.

The Future

The next few decades will undoubtedly bring forth many more spectacular examples of supersonic rocket aircraft and guided missiles. In the latter field especially, progress will be very marked, leading eventually to the production of very-long-range intercontinental missiles. Of course, not all missiles will necessarily be rocket-propelled (for some classes, ram-jet or even turbo-jet engines have considerable claims); however, the trend towards rocket propulsion is inevitable as higher speeds and altitudes (or—indirectly—longer range) are demanded.

The implication of all these developments to the Services would seem to be fairly obvious in broad outline, although far from obvious in detail. In the first place, it seems that they must result in a continued and increasing trend towards the need for more specialists with highly technical qualifications, as ground staff for both operational and maintenance duties. Correspondingly, the demand for large numbers of non-specialist personnel should decrease, if the conventional armies, navies, and air forces begin gradually to be relegated in the main to roles of providing occupation forces and transport facilities. The Navy, however, might very well find itself called upon to fulfil an important new function of providing specialist ships, perhaps large nuclear-powered submarines, as mobile bases, which it would be difficult for an enemy to locate and destroy, for launching retaliatory guided missiles. There might also be some use of piloted rocket aircraft of extremely high performance for bombing or missile-launching duties, or even for reconnaissance, if such futuristic schemes as those of Sänger[2] in war-time Germany, or (more recently) of Dornberger[3] at Bell in the United States, finally prove worthy of attention.

As to how long such changes may take to come about, all that can be said with any certainty is that it will be a very much longer and more gradual process than is usually suggested by the prophets of push-button warfare in the more sensational newspapers, but perhaps not quite so long as the most conservative armchair sceptics may believe. If I may refer you to Field-Marshal Montgomery's lecture last October to this Institution, I think you will agree that this is the general impression he gave, when he was discussing such developments as the long-range ballistic rocket. It is not here yet, it still will not be for some years to come, but one day it is likely to

[1] *Guided Missiles*, by G. W. H. Gardner, D.G.T.D. (Air) at M.O.S. James Clayton lecture to Inst.Mech.E., 1954.

[2] *A Rocket Drive for Long Range Bombers*; Deutsche Luftfahrtforschung UM 3538; postwar reprint by Cornog (990, Cheltenham Road, Santa Barbara, California).

[3] *The R.A.F. Flying Review*, December, 1954, pp. 15–17.

supersede the strategic bomber as the dominant factor in at least the early stages of any major war. Its very existence as such a factor, together with the truly horrifying capabilities of the nuclear warheads which it would deliver with so little risk of any interference, may constitute our best hope that such a war will never occur at all. The potential aggressor would have a perfect weapon for instant attack, without any appreciable warning, but stalemate would result from his certainty of an immediate and equally devastating retaliation.

We must, indeed, fervently hope that this will prove to be so. Otherwise, I am afraid that most of the further possibilities discussed in this paper may be of no more than academic interest to our civilization.

Because the long-range rocket is certain to be produced in the relatively near future, we may also be fairly sure of at least one further development. Probably within the next decade, some adaptation of such unmanned vehicles, to form a multi-stage rocket assembly, will be used to provide the Earth with a small and probably temporary artificial satellite. The small upper component of this assembly will be given a sufficient circular velocity beyond the atmosphere to enable it to circle the Earth as an artificial moon, the gravitational pull on it being balanced by centrifugal force, as for the real Moon—or (for that matter) as for the Earth in its circular orbit around the Sun. If placed at a height of more than a few hundred miles, such a satellite rocket would remain in position indefinitely without further propulsion ; otherwise, the residual air resistance would bring it down within a few days or weeks, to be destroyed by aerodynamic heating before it reached the ground. It would carry automatic instruments which would radio their readings of scientific data back to base, and it would form a most logical and invaluable extension to the large programme of high-altitude rocket research which the Americans have already undertaken. This is a project which has received a very great deal of serious scientific attention in the United States and elsewhere during the last few years.

What *could* happen, as a further development from this first modest achievement of rocket flight beyond the atmosphere, might bear much the same relation to it as does the whole field of modern military and civil aviation to the first model aeroplane of Henson and Stringfellow in the mid-XIXth Century.

Larger winged satellite rockets, capable of carrying human crews and landing back on Earth as high-speed gliders, could be built. Eventually, large permanent satellite stations might be assembled out in space from pre-fabricated components laboriously ferried out by such vehicles, which would also be used to relieve their crews and supply them with essential stores. Von Braun, incidentally, has frequently[4] emphasized the potential military value of satellite stations of this sort, as invulnerable bases for reconnaissance and missile-launching. This seems highly improbable, for if one nation could establish such a station, it should not be beyond the powers of another to bring it down. Professor L. H. Thomas of Columbia University has recently suggested[5] the obvious way to do this, by exploding small guided missiles approximately in the path of its orbit, and so providing a cloud of what might be called cosmic shrapnel capable of puncturing its skin. However, this is not to say that piloted satellite rockets could have no military uses, even of the kind envisaged

[4] Various articles in *Colliers' Magazine*, etc., reprinted in book form as *Across the Space Frontier* (Sidgwick & Jackson).

[5] *A.R.S. Journal*, Vol. 24, No. 5., Sept.–Oct., 1954, pp. 321–322.

by von Braun, provided they did not linger over-long in stable, predictable orbits. Indeed, the craft envisaged by both Sänger and Dornberger, already referred to, are not very far removed from such a class.

In the same way as space stations might be constructed, and in all probability sooner in time and with fewer difficulties, specialized rocket vehicles for the navigation of outer space might be assembled beyond the atmosphere. Their propellents could be ferried out to them for repeated voyages, again making use of the winged satellite rockets for this refuelling duty. There is little doubt that the future could also bring the application of nuclear energy to rocket propulsion.

Voyages, first to circumnavigate the Moon and the nearer planets, and then to land on their actual surfaces and return, could become feasible. In a very much more distant future still, it is conceivable that our descendants, having at their command resources of power of which we can but dimly dream, might even attempt interstellar travel. The distances to the planets are up to a million times as great as those we are normally concerned with, but those to the stars are a million times greater again.

Outlined so briefly in this way, all these possibilities sound almost as fantastic to me as I am sure they must do to most of you. However, by the use of one form or another of rocket propulsion, or some future development arising from it, all of them may very well be realizable by our descendants. There is no time or space here to enlarge on the difficulties—which are, of course, immense—or on their possible solutions. It will have to suffice to say that all these matters have received serious and increasing scientific study during the past generation, and that there are very good reasons for believing that no insuperable obstacles exist to prevent the eventual achievement of interplanetary flight. There is now a considerable body of published literature which justifies this view. (A selection of references is quoted at the conclusion of this paper.)

It should also be emphasized that no responsible member of the growing band of believers in space-flight expects it to be achieved in the very near future. It may be 50 years or more before a man lands on the Moon, but it is nevertheless quite reasonable to predict now that such an achievement could one day be possible. The foundations for it are already being laid in all the contemporary rocket research for military and other purposes.

Even 100 years ago, there were quite a number of people who believed in the practicability of human flight. As far as I know, none of them dared to predict supersonic speeds, or trans-Atlantic commercial airlines, or that aviation would come to dominate military affairs. However, today we all have the example of the last century of scientific and technological development behind us. We should therefore feel more confidence in forecasting what might be possible in the future, without any violation of known scientific principles, and, indeed, merely by their very application. I believe that it is in fact desirable to make such attempts to foresee our possible future.

Another point which should be emphasized is the gradual nature of the future development expected for astronautics. It will be an evolution, closely analogous to what in fact *has* happened in aeronautics. One step, one invention or discovery, one practical achievement, will lead logically to the next one, so that (at the time it is actually made) it will no longer seem quite such a fantastic or impossibly daring thing to attempt as it now does to us, for whom most of the history of the subject still lies unwritten in the future.

To those of us who would like to see space flight achieved, the biggest doubt does not concern its technical difficulties, great as they are. Rather, it concerns the immense cost and effort which would be required to achieve it. These considerations immediately involve us in problems of finance and politics, and in quite fundamental questions of human motives, with which the present writer (among many others) has attempted to deal elsewhere[6].

It is certain that a complete programme of research leading to interplanetary flight would involve the expenditure of many thousands of millions of pounds, spread over several generations. However, much of this money will in any case be spent, for quite different reasons, on such predominantly military projects as aeronautics, guided missiles, and nuclear energy. There are also some quite valid 'practical' reasons for achieving the earlier phases of space-flight, such as the satellite vehicles, and these may in themselves ensure its adequate support initially. Finally, however, there must come the later, purely interplanetary, phases of the development.

It is hard to believe, especially in view of the widespread and growing interest in the subject, that humanity would accept indefinitely a turning-back at this point. Given the existence, or even the practicability, of adequate ships, the great voyages of exploration of the XVth Century seem, in a sense, to have been an inevitable consequence of the questing spirit of man. Our species has always placed a fairly high priority on such projects as building large astronomical observatories to study distant galaxies, or to exploration of the poles and other remote regions, or to climbing Mount Everest, even when these have shown beforehand little obvious promise of a practical reward. (In passing, it may be observed that there has been a long tradition of Service participation in many such projects of the latter kinds.)

It must also be remembered that we are discussing a development of the future, and mankind is far from completely constant in its assessment of those objects which are most worthwhile. A future world might conceivably consider the expenditure of some of its wealth and energies on the exploration of space as being less wasteful than the huge armaments budgets and recurrent wars of the first half of this XXth Century.

For all these reasons, many of us feel that when space flight is technically practicable, as we believe it will become during the next few generations, then it will in fact, sooner or later, be achieved.

The Implications

The implications of all these developments to human society fall into two classes, the physical or material, and the psychological or (some would say) spiritual. It is proposed to discuss them under these headings.

(*a*) *Physical.* The first and quite indisputable fact to consider is that the development of rocket flight beyond the atmosphere will add greatly to our scientific knowledge. Indeed, it has already begun to do so, as pointed out earlier in this paper. Most people with any claim to culture recognize the intrinsic value of pure knowledge, in the same way as they appreciate the value of beauty in a work of art: it is often difficult, for those with some feelings in both fields, to distinguish between the two things. To the extent that this is true, discussion of the point might well be postponed until the next section.

However, if the past century has proved anything at all, it has clearly demonstrated that the apparently abstract piece of scientific knowledge of one generation,

[6] *B.I.S. Journal*, Vol. 13, No. 1, Jan., 1954, pp. 1–27.

or even one decade, is the basis of important military and civil applications in the next. The electrical phenomena which were the curiosities of Faraday's laboratory before many years were giving light and power for cities and providing long-distance communications by telegraph, telephone, radio, and television. More recently, we have seen the academic arguments of pure physics in the nineteen-twenties develop into the greatest potential means of waging war, or of replacing our decreasing stocks of coal and oil as a source of energy.

No method of gaining scientific data, then, is to be lightly dismissed as a thing of no practical importance. The high-altitude rocket has already made considerable contributions to our knowledge of conditions in the upper atmosphere as regards such matters as the propagation of radio waves, meteorology, solar phenomena, and cosmic radiation. The latter subject alone is of immense significance to our understanding of nuclear physics, for the primary cosmic rays (which do not penetrate through the atmosphere to sea level) consist of particles of higher energy than any which can yet (or perhaps ever will) be produced in a laboratory.

When rocket vehicles, first unmanned and then later with human crews, can achieve extended satellite flight in space, their usefulness for gathering such data will be greatly enhanced. Astronomers, too, will welcome the eventual possibility of placing their telescopes and other instruments beyond the blanket of the Earth's atmosphere, which seriously hampers almost all observations, even from regions of cloudless skies. Astronomy is, of course, no purely academic study ; it has been the nursery of many practically useful discoveries and inventions, from navigation to the thermo-nuclear reactions.

It is very likely that the end of this century will see permanent satellite observatories of various types, circling in different orbits beyond the atmosphere. They may be space stations of the kind envisaged by von Braun and others, or (perhaps more probably) they may be large rocket vehicles relieving one another periodically, as the weather ships do now out in the North Atlantic. Some will be concerned with astronomical observation ; some with weather forecasting, having the whole of the world's weather in view ; some may be employed as navigational aids for surface transport, or for surveying the Earth's surface ; others again, for various types of scientific research which we cannot yet envisage. It is interesting to speculate on what new knowledge in physics might emerge from experiments in the gravity-free and airless conditions of outer space.

One particularly interesting practical possibility concerns the use of satellite rockets as radio-relay stations for the short wavelengths which otherwise are restricted in range by the Earth's curvature. Signals beamed out to one such station could be relayed to another to be re-broadcast, and so on, so that complete global coverage could be obtained. For this purpose, there is a particular virtue in the use of the so-called " 24-hour equatorial orbit " at a radius of 26,000 miles. A rocket or other body maintaining this orbit would need to have a circular velocity resulting in its keeping station permanently above a particular point on the Earth's surface, for its angular velocity would have to be equal to the Earth's. It would thus be an artificial moon which never rose or set. Perhaps all the very-long-range television and telecommunication transmissions will eventually be made in this way.

Further away in the future, but not by any means inconceivable, is the possibility of Earth's one day receiving other material benefits from the rest of the Solar System. Our descendants of a few centuries hence may be very interested in imports from the

Moon and Mars. However, we can no more usefully speculate on these things in any detail than could the XVth Century mariners on the products of the New World. Like them, we have to get there first. We shall not achieve this for some time, and when we do, in the first place it will be in ships of a payload limited to bringing back only a few specimens.

(*b*) *Psychological.* Some of the effects of the new knowledge which the rocket can help us to gain have already been mentioned, even apart from its material results and its applications to new or existing fields of technology. Physical and astronomical observations made out in space may give us some new understanding of the structure of matter and the laws of the Universe. If this proves to be the case, the rocket will already have begun to impinge on human affairs, in a non-material sense. However, there are other ways, more purely psychological, and probably more important, in which this may also be true.

The history of science affords many examples of theories and discoveries which have profoundly affected the consciousness of all civilized men, ever since the times in which they were made. These effects, in the long run, have probably been more important than any of the more obvious practical consequences of the developments in question. They have altered the perspectives of human society and the whole attitude of men towards themselves and their environment. The changes in our thinking which followed the Copernican revolution in astronomy, or Darwin's work on evolution, or Freud's ideas on psychology, are cases in point.

Outside the world of science and technology (though often made possible only because of it), there are many other fields of experience which have rather similar implications for the individual and for society as a whole. The discovery that there was a whole New World across the ocean made a great impact on the Europe of Columbus's time, by no means in only a material sense. Most people can appreciate something of the feelings which mountaineers say they experience when standing on the summit of some great peak. Indeed, many of us have felt much the same emotions when flying at great heights, above an unbroken cloud layer or a landscape which has taken on the character of a vast relief map. It is also universally recognized, even among landsmen, that sailors acquire some new understanding from a lifetime of navigating the great oceans.

In the ultimate analysis, all these things amount simply to the fact that any novel experience or knowledge in some way enriches and subtly modifies the individual who undergoes it ; it enables him to see himself and the world in perhaps a slightly different light, and often to realize that things are far from being what they superficially appear to be. We acknowledge this same principle on the humdrum level of everyday life, for we usually tend to disparage the opinions of those who have never departed far from their native heath or from some particular occupation in which they have led their whole life. We say that such people need to get out in the world, to broaden their outlook.

The achievement of space-flight could hardly fail to be an immensely broadening experience of this sort for the whole of human society. In these days of film and television, its impact would not be felt only by the select band of pioneers who first savoured its adventure. On the contrary, it would, in a very real sense, be shared by the whole of human society. One can easily imagine the world gazing in awe and wonderment at its television screens, when the first satellite rockets are circling out in space. When these showed the Earth as a globe in space, one world among so many,

with half the Universe above and half below the tiny man-made vehicle from which all the stars of the heavens were observed, can it be doubted that we should all be influenced in our ways of thinking?

The contemplation of a clear night sky is often recommended, and rightly so, as an antidote to any excessive pre-occupation with personal problems or other mundane affairs. How much more effective still would be the change in perspective obtainable by viewing the whole Earth, our native planet ever since the birth of our species, from outside! Perhaps we shall come to realize that some of our petty concerns are not so important after all: perhaps, in some future society, the exploration of space may come in time to be accorded a higher priority than many of the 'practical' affairs of XXth Century man. At all events, it would provide a preferable alternative to recurrent global wars for absorbing all the aggressive and expansive energies of mankind.

There has long been agreement among journalists that the discovery of life on some other world would be one of the biggest stories which could ever break in Fleet Street, if not the biggest of all. For that matter, the negative discovery that we were alone in the Universe would be of equal, perhaps even of greater, philosophical interest. It is quite possible that intelligent life does not exist elsewhere in our own Solar System; most reliable authorities would say that there is even a high probability that it does not. However, there is also increasing agreement among them that somewhere in the Universe, a great many other planets must exist, and it would surely be a most anthropocentric view to believe it likely that Earth alone harbours what we are pleased to call an intelligent species. There remains, of course, the fascinating possibility that life elsewhere might take some form which is quite alien to our present experience or understanding; I do not necessarily mean alien in any hostile sense, but merely quite different in its essential processes. It is amusing to speculate that a race of underwater beings might decide, quite conclusively, that life would be impossible on dry land, in the heat of the sun, in a gaseous atmosphere of nitrogen and oxygen. . . . .

Our first meeting with an extra-terrestrial species may occur in the not too distant future, or it may be further ahead in time than the Pharaohs lie in the past. It may be never, but if it ever *does* come to pass, then it will surely contain the most exciting implications for humanity which could possibly be imagined. If one regards these as inevitably dangerous, I believe one is sub-consciously judging all potential life on the bad past record of our own species—an interesting and provocative thought in itself. It is at least possible that the human race would gain immeasurably from such a contact with the science, art, and philosophy of another world, which had developed quite independently and which might well be more advanced in its culture.

Argument by analogy can never be conclusive, and in any case, as I have already observed, history never exactly repeats itself. However, it is hard to avoid drawing the comparison between our potential ability, within the next few decades, to make a beginning on the conquest of space, and the adventurers of the first Elizabethan Age who first crossed the wide oceans. Even the natives of Polynesia made their outrigger canoes and crossed the vast Pacific, from one little island to another. So also, sooner or later, man must build his ships to explore the immensity of space and the many strange worlds which it contains.

Conclusion

This paper will have achieved its object if it has convinced at least some of its audience that the eventual implications of rocket propulsion extend far beyond any considerations of supersonic aircraft and guided missiles.

Indeed, it is hardly an exaggeration to claim that, in their full potential, these implications may be as far-reaching as those of any other idea or development which can be found in the whole present field of human activity. Because of their content of physical adventure and excitement, they are made use of by authors of works of fiction, sometimes of only a juvenile, sensational, or mediocre quality. However, they are also deserving of study by philosophers, social scientists, and other more serious imaginative workers, and indeed by us all. Our times have produced too many examples of great innovations for which the world has been quite unprepared by adequate prior consideration of their implications ; usually, we have been sceptical of their importance, and have discovered otherwise to our cost.

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Discussion

Captain I. G. Robertson, R.N. : May we have the lecturer's own personal opinion about flying saucers ?

The Lecturer : When I discussed this some time last year with an American scientist, he told me that he would believe in them when an Englishman saw one ! I do not believe in the current crop of stories about them. I think we have to recognize that if we are prepared to believe, as I am, that we shall reach other worlds one day, then it is theoretically quite feasible that they will reach us first. It is possible that they have already done so, but we have no record of it. I am frankly sceptical about the current crop of stories because of the circumstances in which they are usually put forward. I think it is more likely that those of the stories which are not deliberate hoaxes are either the result of mistaken identification or else of some natural phenomena which we do not understand. It is the sort of thing which one cannot very well prove but a great many cases have been carefully investigated by the Americans in particular, and I think it is very likely that all of them have some such explanation.

Lieutenant M. Reid, R.C.N. : With regard to the human aspect, can the lecturer state how the human being would react to cosmic radiation ? Has it been proved that the human being can live in the cosmic radiation region ?

The Lecturer : This of course is not my own particular field, but my friends who understand more about it than I do assure me that it is very likely there will be no excessive danger from cosmic radiation. I think that the average level of radiation intensity is quite low in space beyond the atmosphere. The unknown danger arises from the very high energy primary particles, which may have some local damaging effect. More data is required on the matter. It will gradually be amassed from the first experiments of rocket flight into the upper regions of the atmosphere. Quite an amount of data will be acquired from instruments sent out in unmanned rockets first of all.

THE CHAIRMAN: What about solar radiation and its effect on people and on material? We are shielded by the atmosphere but what happens outside it?

THE LECTURER: I think that it will be necessary to cut out the worst of the ultra violet. So far as the effect on materials is concerned, I think you have in mind the question of heat or cold. You cannot specify the temperature of space. It depends where you are relative to a radiating body, what sort of container you are in, and whether it is a good reflector or an absorber of radiation. You can then calculate the equilibrium temperature in space, and in the vicinity of the Earth it is quite reasonable. There would certainly be some regions which one would not be able to approach, but it does not present any insuperable problem.

SQUADRON LEADER R. P. DE BURLET: There has been a good deal of reference to the danger from radiation, but is there not some danger from more solid objects? The meteorites which land on the earth are solid and it would seem that there might be some danger from them flying through space.

THE LECTURER: There are a great many meteors but there is a good deal more space! In the last ten years we have learned a great deal more about the frequency of meteors in space. For one thing they are counted regularly now by radar and, from the best information on the intensity of meteors, it can be shown that the statistical risk of hitting one is very small. It is rather similar to flying and risking collision with a bird. It is a real danger but not a great one.

Even if there were collision with a meteor the danger would not perhaps be quite as great as one would imagine. You would build a light outer shield for the vehicle, a few inches from the main structural skin, so that any meteor—and remember they are like specks of dust or grains of sand—would hit the outer shield and would immediately vaporize. The risk of another meteor hitting the same spot would be negligible.

COMMANDER C. V. S. MALLESON: On the question of guided missiles, last October Field-Marshal Montgomery said that aircraft carriers were obsolete. It would seem, however, that both the British and American Admiralties take the view that the aircraft carrier together with the guided missile have an important part to play in the future. Someone must be wrong. Would the lecturer care to express an opinion on this?

THE LECTURER: I think that the Navy will have a very important role to play as a launcher of guided missiles of the offensive type, because after inter-continental missiles have been launched from big land bases, those bases will be vulnerable to counter-attack. On the other hand, you could launch an enormous rocket without any elaborate platform from a ship. There is no recoil from launching a rocket. In fact, the V2's were launched from the streets of The Hague, and a much larger scale extension of that would be to have fairly large ships which carried two or three and to launch them from a point at sea so that the enemy would not have the faintest idea where they were coming from. Therefore, I think that the Navy has an important role to play, but it is purely my own opinion.

In the more immediate future, and thinking of defending a fleet as we know it today against air attack, obviously the guided missile has an important role. There may be other ways in which the aircraft carrier can be made less vulnerable. I think that the thought which was in the minds of many people was that the flight deck of the aircraft carrier was very vulnerable to damage, and it may be that there are several ways in which this could be overcome. For example, the use of jet-lift aircraft is one obvious way of making it possible to cut down the flight deck size.

LIEUT.-GENERAL SIR GIFFARD MARTEL: I am wondering whether the lecturer has not treated cosmic rays rather lightheartedly. We know they come from the sun and go through twenty miles of air, which renders them harmless. When the cosmic rays have passed through the upper air only, it is believed that we need something like 12 inches of lead or six feet of concrete to keep them off if we want to live. Are we wrong in the theory

that these rays go through space or is there some means of keeping them off which is better than 12 inches of lead of six feet of concrete ?

THE LECTURER : Basically, the argument is that it may not be necessary to keep them off. Cosmic radiation is going through us now and not doing us any harm, Originally, cosmic rays are relatively small numbers of high energy particles moving very fast indeed. They strike the very rarefied upper levels of the atmosphere and cause atomic disintegrations, which result in showers of secondary particles, quite an amount of which reach the surface of the earth.

The medical people concerned with the effects of radiation on health have a standard measure, called the Roentgen, of damage to human tissues caused by radiation. As I understand it, this is a measure of the degree of ionization produced by all sorts of radiation in 1 cc. of water, and on that basis if you measure this dose in Roentgens, the worst level of activity is somewhere up in the atmosphere where there are a great many of these lower energy secondary particles. In fact, it is about 40 miles up. You are safer at sea level than at 40 miles up and you get safer again as you go higher. On that basis, it could be argued that if the radiation level were acceptable at 40 miles up, it would also be quite all right out in space, but the unknown quantity is whether in fact this is a true measure of the danger to a living being, of whether in fact the primary high energy particles might not cause some local damage to some vital function of the human body. The experts in this field take the view that it is unlikely that there would be really serious danger, unless one was exposed for a very long time, out in space. It is possible that these rays could be allowed to come through the ship and pass through the crew, without causing any more damage than is caused to you or me at sea level.

SQUADRON LEADER C. J. WOODWARD : Would the lecturer give us some idea of the principles of guiding transcontinental missiles, presumably either by aiming, use of a beam, or by radar ? Whichever method is employed would present peculiar military problems. Also, using progress with the propulsion unit as a measure, can we be given some idea of the progress in the development of the guiding unit ?

THE LECTURER : If I knew the answers to those questions and told you, I should undoubtedly finish up in the Tower of London !

Guidance and control is not my field anyway, but if you are dealing with the purely ballistic missile, one way in which you can make sure that you hit a certain target a long way off is to be certain that when the rocket finishes burning, it is in exactly the right place, going in the right direction and at the right speed, to finish up where you want it. It is then the problem of the artillery shell. You could track the missile during the propulsion period and feed in corrections to the course by radio control, to ensure that you finish up in the right condition. This was done with some of the V2's. You can regard the V2 as the prototype of this sort of weapon. They were guided in two different ways, but some quarter of them were guided like this, by tracking them by radar and then cutting off the rocket engine when it was ascertained that the missile had obtained the velocity to follow the right trajectory. The majority of them—due to the Germans' fear of radio interference—were guided by a device which was, in effect, an integrating accelerometer. The accelerations were measured in every plane, and automatically integrated, giving the velocities, and the missile decided for itself when it was moving at the right speed to hit the target.

The technical difficulties are immense, but the principles are demonstrated by the V2. Once the vehicle was moving outside the atmosphere, then any correction of course would have to be put in through the jet itself. The Germans put rudders in the rocket exhaust.

LIEUT.-COLONEL C. W. MUSTILL : Do you think that there is a real danger of the problem of the construction of satellite stations being over-simplified ? There is a great deal of literature published by reputable authorities about such stations, but in none of this literature does there appear to be any particular emphasis on the difficulty of assembling the necessary sub-units at distances up to 2,000 miles out in space. This difficulty is a

very real one, which has been treated in a somewhat lighthearted manner. I would also suggest that it may well be that the construction of the stations will have to await the development of some new propelling medium which produces a much higher velocity in the exhaust gases than 4·5 Km/Sec. which seems to be the maximum at the moment. In fact, the practical details of the construction of satellite stations may be such that they are further off in time than current literature would have us believe.

THE LECTURER: I can only say that I agree with you. I think myself that the construction of these really big assemblies is very much further off than is suggested. I also agree in principle, however, that there is no reason why it should not be done eventually. It would be very difficult to collect all these assemblies and pieces, with no available purchase—rather like trying to do something on ice! A number of these developments are further ahead in time than has been suggested by some people who ought to have known better, and I include von Braun in that category. In practice, he is much more realistic than some of his published statements have suggested. What he is mainly concerned with is putting over the principle that these things can be done, that there is no flat contradiction of any law of nature in doing them, and thereby arousing interest in the subject. I do not believe in this sort of policy. I think it is better to be honest and realistic about it, and I do agree that the whole business is further off than he has suggested. At the same time, I am equally convinced that it will come.

SQUADRON LEADER R. P. DE BURLET: The lecturer touched very briefly on a point in connection with nuclear power-plants. When the *Nautilus* was launched the Americans discussed the study of an aircraft nuclear power-plant, and although nothing has been said about how the *Nautilus* works, is there any theory by which nuclear power can be supplied for the purpose of propelling an aircraft and, if so, how would it be done? Would it operate a jet?

THE LECTURER: There has actually been quite a fair amount published on this sort of thing. The obvious way of doing this—in a sense it may sound a rather pedestrian way of doing it—is very closely analogous to the use of nuclear power in power stations or in the *Nautilus*.

The nuclear energy is not used directly. It is used to produce heat in a reactor, and that heat is transferred either directly to some working fluid or (as a matter of convenience) often indirectly, by some secondary heat transfer fluid. The heat from the nuclear reactor may be transferred to some high pressure gas or liquid which can, in turn, transfer heat to the working fluid. This working fluid which may be steam or compressed air, is used to drive turbines in the normal way, which can then drive a dynamo or propeller. Alternatively, it can be directly exhausted to form a jet. If you can imagine a turbo-jet engine in which, instead of having a combustion chamber in which the air passing through the compressor is burned with the fuel, the air is passed through a nuclear reactor and so heated up to drive the turbine, that is a possible aircraft atomic power plant.

The rocket application, which has also been studied theoretically, is rather similar. One can imagine a rocket chamber, like the combustion chamber of a conventional rocket, in which there is some sort of nuclear power source. You pump a fluid, which might be water, into this, it would be heated up by the nuclear reactor and converted into steam at a high temperature, and the steam would be exhausted through a rocket nozzle. It is a somewhat pedestrian way of applying nuclear energy, but it could show to great advantage technically. You can choose more suitable gases, of lower molecular weight, for expulsion. They are not limited to those gases which result from some chemical reaction, which is an advantage. You could choose as a working fluid ammonia, or even hydrogen.

THE CHAIRMAN: There are just one or two thoughts that I should like to leave with you. If one should think that what we have heard is somewhat fantastic, I would point out that scientific and technological knowledge has increased enormously. We are now possessed of so much more knowledge than we had years ago. To take, for instance, the question of atomic power, I suppose it is about 50 years ago that people started consider-

ing splitting atoms. It is perhaps 25 years ago that atoms were split artificially, and about 13 years ago that people started to consider that some use might be made of splitting atoms. Then it was some 10 years ago that the first atom bomb actually burst, and it is within the last month that the five-year-plan for nuclear power stations has actually been published by the Government and is to be carried out.

On the other side, I should like to suggest that under the shadow of modern warfare it is at least possible that we may think better about this business of getting at each others' throats, and turn into more useful channels the combative energies which the human race seems to have possessed since its beginning. Wars have shown us what can be done when we get together to do things in a big way. For example, I would revert to the atom bomb project in the United States and this Country during the last war. It seems possible that if wars ceased and we all ceased to use our energies along those lines but combined our energies to consider other things, projects of the sort outlined this afternoon might well become practical possibilities from the human as well as the technological and scientific points of view.

On your behalf I have much pleasure in proposing a hearty vote of thanks to Mr. Cleaver for his most fascinating address. (*Applause.*)

THE GREENLAND EXPEDITION[1]

By Commander C. J. W. Simpson, D.S.C., R.N.

On Wednesday, 2nd February, 1955, at 3 p.m.

Admiral of the Fleet the Earl of Cork and Orrery, G.C.B., G.C.V.O., in the Chair

The Chairman: It is my privilege to have to introduce our lecturer this afternoon, Commander Simpson, of the Royal Navy, who in addition to his naval activities, which have been many, has had as hobbies mountaineering and Arctic exploration. In 1948, he recommended to the Admiralty that an expedition to Scoresby Sound, in Greenland, would be of value, both from a scientific and from a naval point of view. The suggestion was favourably received, but, as is so often the case, it was put off, and so as a rest before greater exertions he went to the Polar regions with a Danish expedition. On his return he was able to put a thought-out plan before the authorities, who this time took it up and formed a committee of which Admiral of the Fleet Sir Algernon Willis was chairman. The arrangements were made, and were greatly helped by the Service Ministries.

I now call on Commander Simpson.

LECTURE

THE story which I have the privilege of telling you this afternoon concerns the activities of 30 young scientists and members of the Services in Greenland during two years, from 1952 to 1954.

Although from a practical point of view scientific research and survey were the two main objects in the field, the expedition was also conceived to gain experience of living and travelling in the Arctic and learning how best aircraft and vehicles might be used for Polar exploration, experience which would be of value, we felt, to the armed Services. A fourth object, which in a sense stood behind the other three, was to make some further contribution to Polar exploration, which during the last two centuries or more has played its own distinctive part in our Country's traditions. Being myself a naval officer, I am very proud to have been responsible for this new example of what was once a particular interest of the Royal Navy's and I hope you will forgive me if I say that this is the largest Polar expedition which has left these shores for some 40 years.

Our party was composed of roughly half and half Service personnel and civilian scientists. You might call it a marriage between the Services and science, with the City of London as fairy godmother at the christening, because the plan was obviously going to cost a great deal and the infant expedition required endowing. I put forward the proposition that an expedition of this type would have a definite training value for the personnel of all three fighting Services, and that there was therefore a case for them to take part in their own interests, and this was agreed. All the flying was done by the R.A.F., as part of their training programme. The Admiralty lent seven naval officers (including myself) and two petty officers on duty, and supplied us with much food and clothing. The Army gave us similar support, supplying four officers or non-commissioned officers and more stores and clothing. Each of the three Services itself bore the cost of the part played in the expedition. On top of that

[1] A map faces p. 398.

we had to raise between £70,000 and £80,000. Most of the money came from business concerns who helped us both with gifts in kind and in cash. Certain powerful shipping and oil interests took the lead in generosity. So that it is true to say that the business world became our fairy godmother. We have already raised and spent about £75,000, and there is very little left in the kitty now. But we shall have to raise about another £2,000 somehow to enable the scientists to complete their work and publish their results, so if any reader has £2,000 in his pocket he knows what to do with it! This union of the Services, Science, and Commerce was the basic principle on which the expedition was built up. The actual scientific programme was a continuation, in some sense, of the work done by a French expedition in the southern half of Greenland. We wanted to study in the northern half, which is much more inaccessible, and to learn all we could about the physical nature of the country.

The importance of Arctic flying needs very little emphasis today. Not much more than a month ago a new route was opened by Scandinavian Airways from one of the Scandinavian capitals to Los Angeles, passing right over the middle of Greenland. Wherever there is flying, whether Service or civilian, meteorological information is of vital importance, and this was one reason for studying the meteorology of Greenland. In addition, the great ice sheet is a weather-maker, and the fact that it exists has a good deal to do with the kind of weather which we get in this Country.

The glaciologists were also interested in the weather, because their line of study was the reason for the existence of the ice sheet itself. They wanted to draw up a kind of balance sheet between the rate at which it grew bigger, due to snow and hoar frost which collected on the surface, mainly in the Winter, and the rate at which it grew smaller, because it is slowly flowing outwards from the centre, and when it gets near the edge the lower part melts and the water runs into the sea. The glaciologists, therefore, were interested in their own direct observations and also in the meteorological observations. They spent their first year working on a glacier near our base, and the second year at North Ice, in the centre of the ice sheet.

The geologists wanted to study the rocks and make a geological map of the whole of Dronning Louise Land, which was almost unknown from the geological point of view. Wherever geologists are working they must have a map, and so we had to make a survey, too, because there was no reliable map of the country. There we co-operated with the Danes, whose country it is. They had excellent air photographs, but no triangulated points on the ground on which to fix the position of the photographs. We arranged with the Danish Government that they would lend us a surveyor, and we would supply an assistant and facilities and undertake the triangulation. Thereafter the Danes would take our triangulation and mate it to their photographs to produce a map.

The two most important lines of research—both in geophysics—were concerned with the ice sheet itself. We made a gravity survey and a seismic survey. The force of gravity, if measured with considerable accuracy, will be found to vary from place to place on the surface of the earth and can be interpreted to tell you certain things about the nature of the earth's crust below. We wanted to make a gravity survey right across the country from coast to coast, about 800 miles, but in order to get the best results we had to know the position of each station and its altitude accurately. The position was easily fixed by astro-navigational methods, but the altitude we had to measure, and this necessitated making a theodolite survey right across the country, a very slow job and a cold one. The gravity team made 350 stations and the job

took two years to complete. I do not think a dual survey of this accuracy right across the country had ever been made before.

Closely connected with the gravity observations was a seismic survey. A seismologist's technique is to fire a small charge of explosive on the surface of the ice sheet and measure accurately the time interval for the sound of the explosion to travel downwards and be reflected back to the surface from the substratum of rock below, which has a different density from the ice. The seismic and gravity teams were equipped with three Weasels[2] each, and they worked mainly along a line running from Britannia Lake through North Ice to Thule, on the west coast.

In addition to the above lines of research work, all of which were connected with the central theme of trying to find out just what Greenland is made of, we had two doctors doing research in human physiology. They used us all as guinea-pigs, taking the opportunity of having two dozen young men in the Arctic to find out what happened to their bodies. Finally, as we had to have radio to keep in touch with the field parties and with headquarters, our radio operators carried on a certain amount of propagation research in conjunction with the Admiralty.

So much for how the expedition was built up; and now our story really begins. I now come to the end of July, 1952, when our chartered Norwegian sealer, the *Tottan*, was going into the pack-ice. We were very lucky that Summer to start with, because the East Greenland Pack can contain some of the heaviest pack-ice in the world. The 300-mile gap between North Greenland and Spitzbergen is the only major outlet from the Polar basin. In the Arctic Ocean the pack-ice circulates very slowly, and may be anything up to five years old when it escapes, to be carried south along the east coast of Greenland by a cold current. The old heavy polar ice is added to the Winter ice, formed on the coast, but it is the polar ice which is particularly hazardous to ships. We got through most of the pack-ice without much difficulty, but at one stage the ship was beset for half a day in heavy ice. Captain Olsen, a veteran ice-skipper, extricated her, and by making a detour to the south we entered Young Sound without further difficulty.

As soon as we got there we started unloading the ship. The Weasels went ashore under their own power. Being amphibious they can do this all right in calm weather. Soon the stores began to pile up on the beach. They included two caravans on sledge runners, which we called 'cabooses'. A camp was set up for the R.A.F. aircrews and ground staff, and a temporary flying base established.

As soon as the Sunderland flying boats arrived they started the airlift to the north. On Britannia Lake we met with the first serious difficulty. We had been able to spend only a short time here the previous Summer on reconnaissance, and then it had been relatively calm for three days out of four, but this year we found a very different state of affairs. It was extremely windy, and winds of gale force would get up in ten minutes or so. The lake was five miles long, and these winds would produce a big sea very quickly. All our boats had to be flown in by Sunderlands, so they were very small. We had some rectangular aluminium pontoons floated on bladders, which could be taken to pieces and loaded in the aircraft. We added to these a couple of very small dinghies of orthodox shape, and some R.A.F. rubber dinghies—in fact, anything we could lay our hands on that was small, light, and would float. In very high winds we met with great difficulties. We had anticipated that this might happen, and to help us the R.A.F. undertook to try to parachute a lifeboat,

[2] Amphibious, full-tracked vehicle designed for travelling over very soft ground.

which would be a great deal bigger than anything else that we had. When the aircraft carrying it arrived after a 2,000-mile flight from home a strong wind had just blown up. When the lifeboat was parachuted I was in a dinghy on the lee side of a Sunderland and did not actually see the operation. Something went wrong with the parachutes which did not all open, so that the lifeboat came down on one end, plunged under water, and was severely damaged. The three of us in the dinghy did not see this happen, and so we did not know that we were on a fool's errand. The outboard engine could not be persuaded to start and so we pulled across the lake for a mile or more. The wind was freshening all the time. As we drew close to the lifeboat we could see that it was badly smashed. We were within 30 yards of it and fortunately to windward when a breaking sea swamped the dinghy and we were capsized, and had to swim for it. We lost the lifeboat and very nearly our own lives as well before being rescued from the icy water, thanks to skilful handling by the pilot of one of the Sunderlands.

One of the first jobs at Britannia Lake was to build our base hut. The site which I had chosen was a sandy cove on the north shore, about 100 yards across. I had been nonplussed to find that nearly everywhere the lake was so deep that there was no possible mooring for the aircraft with a safe margin of distance from the shore. But we found this little cove, and divided ourselves up into three working parties, one to build the hut and the other two to unload the aircraft. The hut had been built in Canada by a firm specializing in Arctic huts, and three weeks later it was almost finished. We rove wires across the roof secured to big stakes to keep the roof in place during Winter blizzards. The hut was in two parts. One contained the main laboratory for the scientists, the radio and generators, a little office, and a dark-room, while the other provided the common living room ; and a passage with six little sleeping cubicles opening off it with four bunks in each cubicle, rather like a somewhat sordid third-class railway sleeper! There was about two feet between bunks and a locker at our feet. There was a galley and a little sickbay in this hut. The two huts were joined together by an aluminium vestibule which was supposed to be fireproof, with the idea that if one hut caught fire there was a chance of isolating it and saving the other hut. That is a very essential precaution in the Arctic, because there may be no water available and a fire can be a very serious matter. The hut was quite comfortable, and a great deal warmer in Winter than my draughty country home in Suffolk !

There was a bank of moraine which formed a point sheltering the cove. A mile and a half to the west was the snout of Britannia glacier, our highway for all journeys to the ice sheet, and beyond the glacier lay a ridge of mountains, and then the ice sheet itself.

By 20th August the airlift was complete, the R.A.F. had flown home, and the 25 of us were left alone. The first important task was to send a dog sledge party as near as we could to the centre of Greenland to receive the airdrop which would supply all the necessary material to establish North Ice station. The aircraft were to rendezvous with our dog teams and if they could find them to drop all the stores needed for the station, and also the petrol needed for the Weasels during the following year. We intended that North Ice, as well as being a small scientific station, should be a petrol-filling station for the Weasels. Our first job, therefore, was to get as near the centre of the ice sheet as we could for the rendezvous. We made a brief aerial reconnaissance, before the Sunderlands left, to look at the bottom part of Britannia glacier. Like the Storstrøm glacier on the other side of the lake, it was

extremely broken and rugged, and we felt that in the Summer, when there was no snow, it would be out of the question to try to sledge heavy loads. So Coastal Command came to our aid again and parachuted the provisions needed for the sledge journey at a point about 30 miles further inland. There was a small outcrop of rock there which we called Farewell Nunatak—a Scandinavian word meaning a point of terra firma which protrudes through the surface of an ice sheet.

After a rather difficult five-day journey up the glacier we reached this place and found most of our parachutes scattered over the snow for a distance of about two miles, but we collected nearly all the provisions and so had enough food for 45 days for men and dogs. That gave us a reasonable margin of time to reach the centre of the ice sheet, wait a week for the aircraft and, if we did not make contact, sledge back again.

Towards the end of August, 1952, we started to sledge westwards from Farewell Nunatak. There were six of us, three to act as dog drivers and bring the sledges home, and three to remain at the station all the Winter. By day we sledged with two men to each dog team and by night we slept three to a tent. At the end of a day's run the dogs were tired and curled up in the snow seeming to sleep, but in fact every dog kept his weather eye open, for they were yet to be fed. Sledging routine is much the same everywhere. When the tent is pitched the man who is duty cook goes inside while the others pass in to him the sleeping bags, sheepskin mats, and ration and cook's boxes. Somebody shovels snow on the back of the tent to keep it down and to prevent it blowing away in the night, while the cook prepares the evening meal of pemmican. That takes about ten minutes, and the dogs know that they have that time to wait for their evening meal. Meanwhile the teams are tethered separately to pickets driven into the snow. You will see each dog with the snow beginning to drift over him, and looking dead to the world, but he is listening intently and when a few minutes later he hears somebody going towards the sledge he will be on his feet in an instant, jumping at the end of his trace and clamouring for the block of pemmican which is his day's ration.

I am now going to show you the first part of the film, which shows this journey and the airdrop which followed at North Ice when we got to the end of the journey. The film starts at the beginning of the day's sledging, with the dogs being woken up. They are huddled together for warmth. The Huskies did not mind the cold, but they do not like being wet. The pace of the sledge journey was slow, because the sledges were heavily laden, with a weight of about 100 lb. per dog. The dogs at that stage were not very fit; they had got very wet during the sea voyage and had not had much of a chance to recover. We had to start sledging, however, to keep our rendezvous with Transport Command, and we lost four dogs from exhaustion on the journey. We stopped 30 miles short of our rendezvous, because they were not in a condition to go on.

The film shows the first parachutes coming down. The R.A.F. parachuted all the delicate stores such as scientific instruments, but most of our food and all the petrol for the vehicles and Diesel fuel for the hut were dropped free. That is an interesting technique and applies particularly to Polar regions. The aircraft has to fly level about 50 feet above the snow and throws out the stores without any parachute. Provided that the aircraft is the right height above the snow and that its speed is right, the stores come down on the snow at an angle of about 45°, bounce once, roll to a standstill, and are very little damaged. Whilst the hut was being

built the airdrop went on all the time, and the loads were sledged in. The dogs hated this, because they disliked stopping and starting, as each package was collected.

On the second day of the free dropping, the pilot of one of the aircraft had a piece of bad luck and crashed. He flew into a patch of bad visibility and learned a very important lesson, that over a deep snow surface the radio altimeter gives bogus readings, and it is exceedingly difficult to estimate height. Some of the parachutes failed in the first year, due, I think, to the cold conditions.

When the aircraft crashed, fortunately only three men were hurt, and they not seriously. The aircrew was rescued by a United States Arctic rescue flight with ski-fitted aircraft a week later.

The North Ice hut was built in a pit about four feet deep to get a solid snow foundation. The walls of the hut were about four inches thick, made of a sandwich of plywood, fibre-glass, and aluminium foil. We waved goodbye to the last aircraft about the first week in October, and the sun disappeared for the last time on 25th October and was not seen again until mid-February.

At the end of October three of us sledged back to Britannia Lake, leaving the other three to keep lonely vigil for the next seven months in what must surely have been the loneliest station in the world. When the first three arrived back at base there was only twilight, and by the end of November it was dark. We then had something like six weeks of complete darkness, day and night.

So we entered our first Winter. One of our biggest anxieties at this time was the lack of snow. We knew beforehand approximately how much snow there would be in terms of so many inches of equivalent water, and we knew that it would be only four to five inches, which is near desert conditions, but we did not know what that represented in practice in terms of the amount of snow which covered the ground. The amount of snow on the rocks and broken glaciers was a very critical factor for our journeys, and as the Winter went on we became more and more anxious, because there was pathetically little snow. The bottom of the Britannia glacier was almost bare ice, for after each snowfall there were so often three or four days of blizzard, when nearly all the snow blew away, perhaps to be deposited far out on the pack-ice. Before Christmas, therefore, we came to the conclusion that we should have to do something about this, or else we should not be able to get our sledge-loads up the glacier in Spring.

During the Winter darkness we did not stop all outside jobs. In that clear atmosphere, at a time of full moon, the light of the moon and stars is brilliant, and the moonlight reflected from the snow makes it possible to see mountains 30 miles away. We decided to man-pack for the first mile or more of the glacier all the stores that we should need for the Spring journey. We all took a share, and by the end of Winter had made a depot of two and a half tons of rations above the worst part of the glacier.

Inside the hut, conditions were very different, and it was warm and snug. The geologists were kept busy sorting and grinding the rocks which they had collected during the Summer. The two doctors were always at work on their poor 'guinea-pigs.' They had a series of routine tests which were carried out on all of us once a fortnight. They woke one up an hour before the usual time and, while one was only just conscious, measured the amount of oxygen consumed. They made one do a pack test wearing a rucksack full of stones a third of a man's weight while one stepped up and down on and off a box; after which one's pulse rate was checked. They

also sampled our blood, never a popular sport, which produced complaints that the needles were blunt! They were interested by the way in which most people got fatter that first Winter—one was required to strip off and lie on a bed in the sickbay while the doctors went all over one taking pinches of fat and measuring the thickness with callipers. Nobody really minded; but we all made a fuss. Everyone thought that alternate Saturdays were fun, because then the doctors would operate on each other and the rest would sit around offering very unmedical suggestions.

There were plenty of jobs to do for those who were prepared to look for them, sledges and clothing to mend, scientific notes and articles to write, and all the domestic chores made harder by the primitive frozen condition in which we lived. Our wireless operators kept in regular contact with the Admiralty, and at Christmas time dealt with about 300 telegrams.

Some people may not call cooking work, but we did. We took it in turns, three men going on cook duty for a week at a time. On Christmas Day three of the chaps volunteered to cook and everybody expected a good deal from them. Christmas Day passed with an extremely good dinner and a highly popular pantomime, the words of which are unfortunately unprintable! We had a strong Scottish minority in the expedition. The Scots are not strong on Christmas but keep Hogmanay in a big way, and one of them had brought his bagpipes with him. Some of us Sassenachs had mixed feelings about this, but the other Scots said they liked it.

So much for indoor life in Winter. We now pass to January, when the darkness is drawing to an end. We were still very much concerned about the lack of snow. The previous Autumn, the Weasels had been landed 150 miles to the south of us and about 100 miles to the east. We had sent a sledge party eastwards across the Storstrøm glacier to a small Danish station called Danmarks Havn. The Danes there —there were about a dozen of them—were extremely helpful and lent us sledge teams—our own were on the ice cap at the time—and so we could take four more drivers to the men who had been landed with the Weasels. The eight men then drove the Weasels northwards along the sea ice as far as Danmarks Havn. The trailers' runners had by then been severely damaged by broken sea ice, and we were glad to accept the invitation of the Danes to leave the Weasels there all the Winter with two mechanics to repair the sledges. With Spring coming now it was vital to get the Weasels across the glacier, because if we could not do so, half our scientific programme would fail at the start. That was one reason why I was anxious about there being so little snow.

As the twilight began to increase, therefore, and before the sun reappeared, two reconnaissance parties set out by dog sledge, one south and one north. We wanted to know where the Weasels could best cross the Storstrøm glacier. We knew from the air that 40 miles to the south was the tongue of the glacier, and where it joined another glacier it was only five miles wide. We felt that if we could reach the glacier in that region where it was narrower, we might be able to cross it more easily. There was considerable doubt, however, about whether we should ever be able to reach the glacier tongue, because the fjord which led to it from the sea was full of icebergs which had been broken off the glacier. We had seen from the air that there was a fantastic number of icebergs, and the fjord, which was about eight miles wide, was choked with them. We did not know, therefore, whether we could ever find a way to the edge of the glacier, and even if we could, whether we could get the Weasels on to its surface.

One reconnaissance party went down the edge of the glacier for 40 miles to see what they could find, while at the same time another sledge party went northwards to see whether there was a possible detour in that direction, because from the aircraft it had looked as if we might there get on to smoother ice and pass round the source of the bigger rivers which cut through the glacier.

The reconnaissance party to the south had a tough time in temperatures down to −45°F., with heavy going. They got to the snout of the glacier, but they had not time, because food was running out, to go further, and they came back with a rather depressing report. The people who went to the north almost broke their sledge, because there was so little snow that the sledge pounded from ice-hummock to ice-hummock, and they had to come back.

By the beginning of February we knew that the sun was not far away. There was a good deal of twilight, and at mid-day something like full daylight. In the second week men were often looking up at the hills to see whether the sun was visible. Then one day suddenly the soft rosy light was there, touching the top of the mountains; the first sunlight for three and a half months. A few days later the sun itself looked over the horizon and we all had our tails up.

Before I talk about our Spring journeys, let us take a quick look round Britannia Lake at the scene disclosed by the returning light. One domestic difficulty was getting water. In these parts to get water you can melt ice or snow, but that means using fuel and is slow, and so it is easier to hack through the ice on the lake and get at the lake water underneath, even though the ice is six feet thick. We used to hack out a basin four feet wide, using the glaciologist's drill to drill down the remaining three or four feet, and then the water would come up through the hole and fill the basin. It was necessary to handle the drill quickly or it would freeze in when the water came up, and once it did so, and then we had to hack away with a pickaxe through six feet of ice and dig a hole six feet across to have room to swing the pick. On one occasion a scientist was at the bottom of the hole hacking away at the ice when he suddenly completed his job, his pick went through and the hole filled up with water. He was down at the bottom of a slippery pit six feet deep and could not get out. He was very wet by the time somebody hauled him out!

At the far end of the lake is the edge of Storstrøm glacier. An ice cliff 200 feet high formed the edge of the glacier. At the other end of the lake there was the Britannia glacier, and this used to calve off icebergs. They became frozen into the lake ice during the Winter. As the Britannia glacier moves slowly forward it makes a wrinkle in the lake ice about 20 feet high; the ice buckles and great plates are splintered and forced up on edge. The water flows in underneath the crack and freezes, making a kind of tunnel which one can creep into in some places, where a beautiful blue-green light filters down through the plates of ice.

We now come to the main Spring journeys, which may be summarized as follows. The first job for the surveyors was to find a way across the Storstrøm glacier, which by then had a little more snow on its surface, and sledge 100 miles south along the coast.

Near Bessels Fjord they made contact with existing Danish Survey stations, and made this the starting point of their own survey. It was during that journey, when Jensen and Brooke were descending a mountain, that the only fatal accident occurred, which resulted in Hans Jensen's death. The expedition lost an able surveyor, and we, his messmates, lost a loyal and valued friend. His companion, Richard Brooke, suffered a severe ordeal.

The geologists sledged to the mountains in the southern part of Dronning Louise Land and spent most of the season collecting and mapping the rocks of that region. The Weasel drivers walked across the glacier to the coast and collected the Weasels from Danmarks Havn. We then made a reconnaissance to the tongue of the Storstrøm glacier, but failed to get on to the glacier, and were forced to return repulsed. The northern detour then offered our only hope of driving the Weasels to base.

The film shows the two surveyors setting out from base. High winds had stripped most of the snow off the lake and polished the ice, which was so slippery that the dogs could not get a grip. One could see from the way in which the dogs slipped and skidded, trying to keep the sledge moving, that they hated the lake. They often made a bee-line for the shore to get off the ice. The party sledged up the glacier, with two more men to help them for the first mile or so. There was still not much snow, and on the broken slippery ice the men had to work nearly as hard as the dogs, who could not get a good grip, poor beasts. That sort of thing makes one's hands very cold. Hard physical work makes you sweat, and then you have a rest or the going becomes easier and you cool off. That is when care must be exercised to prevent frostbite.

The geologists worked hard collecting rocks, and returned after about three months' work in the field. Early in June, there was not much snow on the glacier and they had difficulty in getting down on to the lake, and had to work their way carefully down the ice cliff at the snout of the glacier. A ribbon of open water formed all round the lake ice, which was only connected to the glacier ice by a narrow bridge in one or two places. There was a final cliff about eight feet high, and they had to unload the sledge and pass the loads down separately, and then the dogs, and then the sledge itself.

The king dog of their team was a big red dog, a veteran of unknown age, and a very fine beast with considerable dignity. Huskies are very attractive dogs, apt to be savage with each other but friendly with human beings. They live a kind of Victorian family life. Each team consists of eight to twelve dogs and each has its own king dog who maintains discipline by fighting, or offering to fight, every dog in the team two or three times a day. But they will not stand up to him; they know that he is master, and he keeps good discipline in each team. Each team is at daggers drawn with the next, and you must not let them get mixed up, or blood will flow.

Next, consider the Weasel drivers starting to man-pack eastwards across the Storstrøm glacier, and you will realize how difficult it was to get the machines across. We hated this glacier, and seemed to spend much time walking across it, which meant two days' hard going each time. We drove down the coast on the sea ice and into Borgfiord, where our Weasels threaded their way through the icebergs which choked the fjord. Here we found ourselves in fantastic moonlike scenery sculptured entirely out of ice, some of the icebergs being half a mile long and up to 300 feet high. We used to climb to the top to see our way ahead and then puzzle out a route and drive the vehicles forward for a quarter of a mile, after which we would have to climb another iceberg and make another reconnaissance. We got four or five miles up the fjord and found that conditions got worse, but we managed to reach the snout of the glacier, only to find ourselves confronted by a vast ice cliff 200 feet high, up which we could find no way for vehicles. Two men climbed up, but at the top there were crevasses and it was hopeless for the Weasels. We therefore came back again and tried to cross the glacier further north. Until we tried this alternative we could not tell whether it was possible or not. Two of us 50 yards apart would walk

ahead of the Weasels and try to find the best route, and then return and drive forward along our footprints for a few hundred yards. Then we would make another foot reconnaissance before driving forward again. In this way we made slow progress, and it took us five days to cover the 50 miles to base. We found that the key to the situation was the very obstacles which had been so difficult in Summer, and these were the big river channels. Now they were full of drifted snow, and wherever there was a river bed we had a reasonable highway that we could drive along easily for a mile or two until the river seemed to lead in the wrong direction, and we had to leave it. Some of these channels were 30 or 40 feet deep and full to the top with snow. It was a sort of jigsaw puzzle to find our way from one river to the next, follow its bed a little way, and then take to the excruciating, endless ice-hummocks again.

All this knocked the vehicles about a good deal, and particularly the sledge trailers. At times they got stuck fast and had to be extricated with tow ropes. Their runners were damaged, so that we had to up-end them to do repairs. It was an unpleasant, cold-finger job trying to repair the runners in sub-zero temperatures on that glacier. Sometimes we had to use pick-axes to hack away lumps of ice before we could go on.

We were five days crossing the Storstrøm in all and it was on Good Friday that the first Weasel at last reached base, just in time for Easter celebrations. The remaining five Weasels followed in the tracks of the vanguard shortly afterwards.

As soon as the Weasels reached base their first job was to make their way on to the ice sheet and relieve the North Ice crew, the three men who had been isolated there for seven months. We had been able to talk to them by radio and knew that they were well and content, in spite of spending the Winter in what must surely have been the loneliest station in the world. We knew from experience, while dog sledging during the Autumn and from what we had seen from aircraft the previous Summer, that there were big crevasses along the edge of the ice sheet for the first 50 miles or so, but we did not know how far inland they went. Dog sledges did not seem to be in much danger, because snow bridges covering most crevasses seemed able to bear their weight, and men were all right provided they were on skis. The dogs sometimes fell through, but their traces always supported them until they could be dragged out. But the Weasels weighed two and a half tons, and we were afraid that in going over big crevasses they might break through snow bridges which would support a dog sledge. The only thing to do was to secure the Weasels to one another with heavy nylon ropes with a breaking strain of about 20 tons, and to secure the drivers and passengers in their seats with aircraft safety belts. Those precautions, as you will hear later, saved the lives of two of our party. There were a lot of crevasses, and some of them were fairly large. When covered over with snow we could often tell if one was there by a slight furrow across the surface of the snow, and we would prod it to see if it was secure and how wide. If it was not very wide we would take a chance and try to drive across fast. Sometimes, however, we did not see anything, and the first one knew that there was a crevasse below was when the Weasel gave a lurch and the rear end dropped. The driver would tread on the accelerator and the machine would just be able to lumber forward out of danger. If you got out and walked back there would be a big hole 100 feet deep or more.

When the Weasel team got near North Ice, everybody was agog to know what it would look like after the Winter blizzards had done their worst. They knew that it was completely covered with snow and that the occupants were living a sort of subterranean life, like moles, under the snow. The first thing that they saw was the lattice-

work tower, 30 feet high, which the meteorologists and glaciologists had built. The snow had drifted right up to the roof of the hut. It was not a case of a local drift just round the hut, but a flat dome 100 yards across which had drifted round the hut and the piles of stores and everything else on the surface. It also covered the damaged aircraft, 50 yards away. The three men came to meet the Weasel team. To get to the hut it was necessary to climb down a ladder, and one found oneself in a dim blue light in a tunnel cut out of the hard-packed snow. One had to feel one's way along, and then, presently, the snow gave place to timber and one found a doorknob in one's hand, and on opening the door there was the hut, 15 feet square. The hut was built in the same way as the base hut, and was extremely warm. Passages led away from the hut to a cave for the generators and a longer passage to another cave where the meteorologist kept his hydrogen generating gear and various other stores. The main storeroom was the crashed aircraft, which provided us with an excellent workroom and store.

The seismic team with their Weasels took the station's Winter crew to base and left a new Summer crew at North Ice. They then started their seismic survey, but during the first year got very little by way of results. They tried all the tricks of the trade, but could get few reliable reflections from the bedrock beneath the ice sheet. The gravity team started out from base at the same time as the seismic team and worked slowly across the ice sheet, making their stations about two miles apart. Their progress was cold and slow, because their work had to be meticulously accurate. By the end of the first Summer they had reached about half-way across the ice sheet, that is, 350 miles from base. In the second year they completed their traverse and reached Thule on the west coast.

Now let us leave the ice sheet and go back to Dronning Louise Land, where the glaciologists built a station near the top of the Britannia glacier. They were particularly interested, as I have already said, in the rate at which the ice cap grows in Winter and decreases in Summer. They established two stations and set up their instruments near the top of the glacier, where the two of them spent most of the Summer. At intervals others walked up from base to give them a hand.

Every evening all the field parties used to get on the air and report their positions by radio ; everyone enjoyed these evening radio schedules, the scientists exchanged news and views, and I was able to find out how everyone was getting on.

By July the snow had melted off the glacier, the ice was dirty with dust blown from the land, and many glacier streams had reappeared. Sometimes the dogs were unable to cross these torrents, one had to unload the sledge, using it as a bridge, and carry the dogs across. All the snow around base disappeared, and the dwarf willows and many small Arctic flowers reappeared. It was a delight to find these tiny fragile flowerets hiding amongst the rocks. At home they might seem insignificant, but in that wilderness they were charming and never failed to please.

Animals appeared more, also. They were there all the Winter, but one saw less of them because they were white. The white Arctic hares are often very tame. They have the curious habit of standing on their hind legs as you approach—perhaps to have a better look at you. As you get close, they hop away on their hind legs, looking back from time to time, absurdly like the White Rabbit in Alice in Wonderland.

Early in August, the first Sunderland arrived and landed on the lake. The R.A.F. were back again, based on Young Sound, as before, to bring us our second year stores. The chartered ship broke down and was ten days late, and so everything

had to be done with a rush, but Coastal Command had learned a lot the year before, everything went very smoothly and they shifted 60 tons in eight days. I will not bother you with statistics, but it is interesting to note the total tonnage shipped or flown. During the whole operation we had to ship a total of 640 tons to Young Sound, and the R.A.F. lifted by air to Britannia Lake 250 tons. The total weight of stores which we needed at base was greater than that, but the Weasels went up the coast and across the Storstrøm under their own power. The total brought by air-lift was 250 tons, and to fly that we had to ship 350 tons of petrol, etc., for the R.A.F. That makes one think a bit. It may be relatively easy to fly stores into a country like this, once all the flying facilities have been provided, but you may require a greater weight of fuel and stores for the aircraft than the expedition stores which the aircraft are there to lift.

We had bad luck on the last day, when the airlift was over and the last aircraft was just about to take off. A small iceberg turned over and broke in half, and broken pieces of ice floated all round the aircraft. This prevented the pilot from turning away from land into the open lake, and a contrary gust of wind sent him aground. There was next to nothing with which to repair the aircraft, but we improvised a collision mat which kept the water out enough for the crew to keep the level down with pumps. The fore part of the aircraft where the bottom was holed was then filled with concrete and allowed to harden. This enabled her to be floated off the rocks. I was relieved to see her rise clear of the water, because I was afraid that as she gathered speed the concrete might collapse and the aircraft nose-dive and sink ; but the R.A.F. got her home and completed a very fine job.

By the third week of August the airlift was over once more and the Weasels returned to the ice cap. They went straight to North Ice to receive the second year's airdrop there. Someone failed to spot a crevasse near the edge of the ice sheet and one of the Weasel's tracks broke through and the Weasel rolled over on its side. The incident illustrated the importance of not operating with less than three Weasels in a team if there is any danger of crevasses. It may easily take two Weasels to drag one out of trouble. That crevasse, though frozen over, was full of water, and the Weasel was flooded and had to be baled out.

The second Summer's airdrop at North Ice was very successful. Both the air-crews and ourselves had benefited by the experience of the first Summer, and the operation went very smoothly. We placed the Weasels and trailers in a long line at half-mile intervals. Each Weasel driver was in radio contact with the aircraft and helped the pilot to judge his height above the snow, talking him down to about 50 feet. Instead of the fuel being dropped in jerricans, this time it was dropped in 45-gallon drums, about 85 per cent. full. In the first year we lost between 15 and 20 per cent., but in the second year we lost only two per cent., which was extremely satisfactory. For free dropping in this way, an aircraft height of 50 feet and speed of 120 knots is just right. To fly any lower is dangerous for the aircraft, and the drums bounce and roll more, and hit each other on the ground. To fly higher than this causes the drums to bury themselves deeply on landing with much extra work for the ground party digging them out.

After the airdrop, the seismic team carried on with their survey stations between North Ice and Dronning Louise Land. Our seismic operator tried many different techniques to get reflections, but without much success, on the east side of the ice sheet. In the second year, operating west of Northice, he succeeded in getting interesting results which indicated that the ice sheet in that area was about 9,000 ft.

thick. He found that to the west of a certain line, he always obtained reflections, but not to the east. The reason for this is not known with certainty. One theory is that the insulating effect of the ice cap at its thickest part, combined with the fact that there is always heat being transmitted outwards from the earth's crust, has caused the bottom layers of ice to melt so that there is water and slush there, which will not return seismic reflections. The gravity team spent most of the Autumn working between Dronning Louise Land and Farewell Nunatak—the name we gave to the last outcrop of rock near the edge of the ice sheet.

Both Weasel teams began at this stage to experience many more mechanical breakdowns, and the vehicles gave us a good deal of trouble. They had been given a good deal of punishment during the first year, particularly when crossing the Storstrøm glacier, and now, in the second Autumn, the breakdown rate was very much increased. Various suspension parts used to break, and it seemed that at low temperatures the actual metal became weaker. The wear and tear generally was worse, partly because efficient lubrication was difficult. To get through our programme we were forced to work rather late in the season, after the final setting of the sun; the low temperatures we experienced during October undoubtedly contributed to our mechanical difficulties. It also made the mechanics' task very unenviable and sometimes painful.

Towards the end of October the blizzards increased in frequency. The gravity team had finished the season's work and was going back to base across the edge of the ice sheet. The sun had set, and anyone who has been ski-ing knows that on snow surface in diffused light it is extremely hard to judge the angle of the slope or the texture, and you get into holes which you cannot see. It was a rather tricky state of affairs and the team found it difficult to know whether there were crevasses ahead or not. The two running Weasels were roped together as usual, the leading one towing two trailers and the rear one towing the third Weasel which had broken down. Suddenly the two men in the rear Weasel saw the ground open and in an instant the leading Weasel disappeared, followed by its two trailers, swallowed by the ice sheet before their horrified eyes. The second Weasel was jerked forward violently as the nylon rope became taut, in spite of the brakes being hard on. The crew got out and went very carefully forward, and looked down a gaping hole 20 feet across, with the Weasel jammed about 40 feet down and the trailers piled on top. They called down, and to their relief got an answer at once from the two men, who had hardly been hurt. It seemed a miracle not only that they had escaped serious injury in the initial fall, but also that they were not killed when the two trailers with about a ton of stores fell on top of them. Two ration boxes, each weighing 50 lb., smashed right through the Weasel and out through the windscreen, but never touched the two men inside. The team had several very unpleasant days under near blizzard conditions, but they succeeded in salvaging most of the stores and both trailers; the Weasel, of course, was lost.

In the first week in November, the seismic team had more trouble of a similar nature. We ran into an area thick with crevasses and lost a trailer, the Weasel just managing to get across. We managed to get that one out again also. I was extremely glad when, on 10th November, we got safely back to base. There is no doubt that we had been operating too late in the year, but we accepted the risk in order to get the scientific job done.

The second Winter passed like the first and there is not much to tell about it.

Once a month the B.B.C. made a special broadcast for us. They sent word to our friends and relations and sent us a warning in Greenland. Four or five men's relatives would go to Broadcasting House and send them personal messages. After the sledging season had started, these were relayed to the boys in the field by our own transmitter at base. I remember getting a message from home myself when I was right out near the middle of the ice sheet.

In the second Winter there was much more snow than in the first, and this made life easier for everybody, but it brought its own troubles. The Weasels had to be dug out of snowdrifts, and the garage in which we repaired them was under six feet of snow. We had only the one little garage, which was all that we could afford to fly in. It could take only one Weasel at a time, and so the trailers had to be repaired in the open. That also I remember as a very cold-finger job in February or March.

When the sledging season returned, the surveyors went back to the coast to take a second series of observations across the Storstrøm, where they experienced abnormal refraction. On the fjord they ran into a family of polar bears. They saw the female and two nearly full-grown cubs and knew that the father would not be far away, but could not see him at first. Later the male appeared and was chased and held at bay by two or three of the dogs until the men could catch up and shoot him. The fresh meat was exceedingly welcome for the dogs, and the men themselves were not inclined to scoff at bear steaks!

On the ice cap as the Summer approached, work became easier, particularly for the meteorologist who had a temperamental machine for making hydrogen. We referred to this infernal device as the 'hydrogen bomb.' It was designed for making hydrogen under high pressure in a temperate climate. In theory it was simple; you put in two different chemicals and added water and chemical action took place; pressure was built up, and the hydrogen filled a cylinder at about 3,000 lb. per sq. in. In the cold north it did not work quite like that. You put in the chemicals, added water, and nothing happened. You put in warm water, and still nothing happened. Then you put in really hot water and things happened rather suddenly. It was not uncommon to hear a shout and see the meteorologist running down the tunnel calling out to everybody to put out their pipes because the tunnel was full of hydrogen. The chemical action stimulated by hot water had become so violent that he could not get the stopper into the H-bomb in time!

The welfare of the 'hydrogen bomb' was of considerable importance to the meteorologist, whose work depended on it. He had a lot of trouble with it, and over the radio we often asked him how the 'hydrogen bomb' was getting on. I sometimes wonder if anybody outside Greenland was listening, and what they thought of these references to the H-bomb by radio!

During the Winter and Spring a pit was dug at North Ice, 50 feet deep in the snow. The snow in Summer does not look the same as in Winter, so that by digging a pit and measuring the strata it is possible to measure the age of the snow, just as you can tell the age of a tree by the growth rings. At the bottom of their pit, the glaciologists got back to the snow which fell in the year 1877.

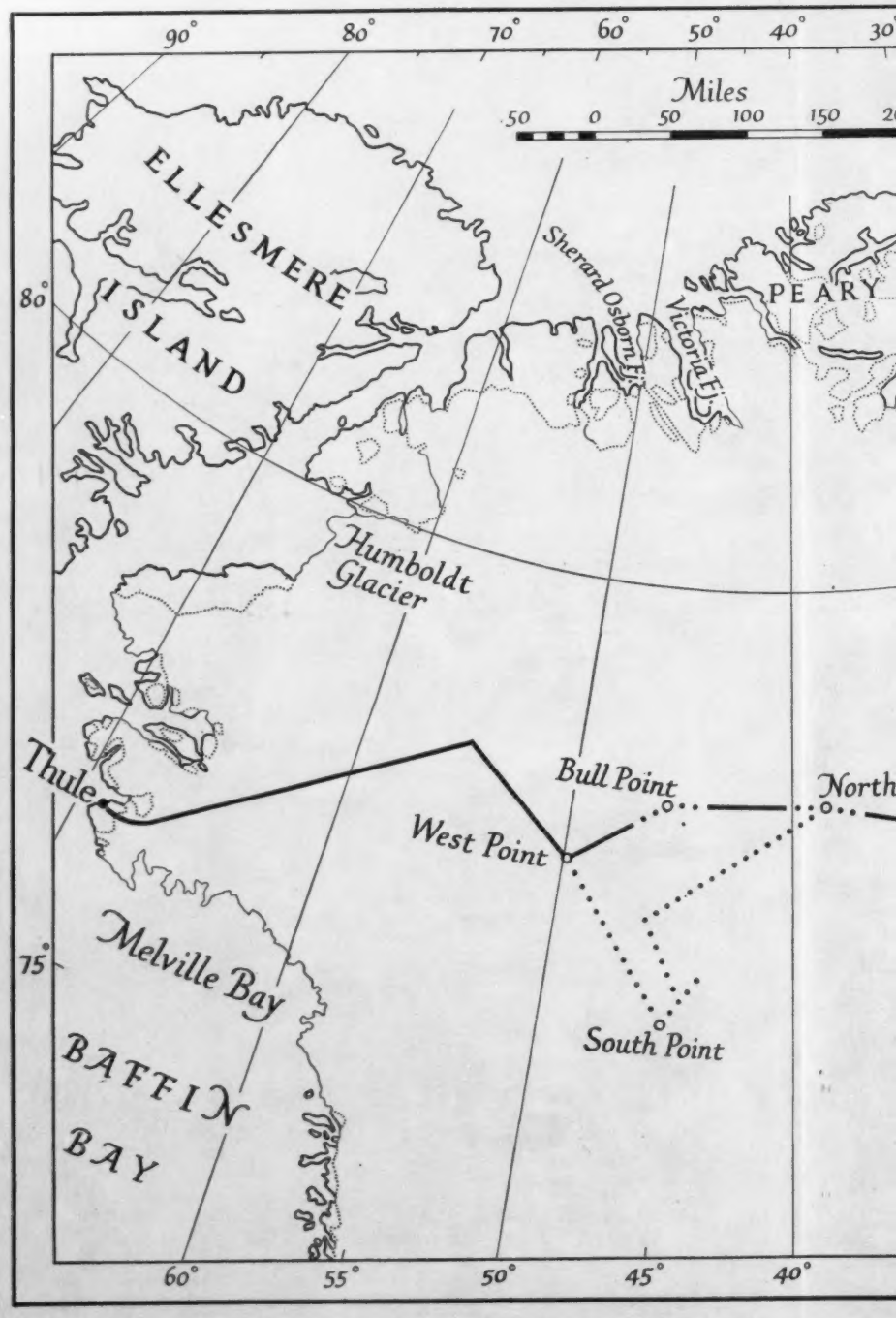
The Weasels continued to give trouble all the Summer. We had done all we could, with our very small facilities, to repair them during Winter, but both teams on the ice cap, far from base, had a lot of trouble and it was touch and go whether we could keep them going. One of the gravity team's broke down completely, and as they lacked the essential spare part, they left it and carried on with only one. Just after that the seismic team had trouble and found that the springs were breaking

due to fatigue and the weakness of the metal at low temperatures. I have talked about low temperatures but forgotten to tell you what they were. A temperature of —40°F. to —50°F. was about the limit for outdoor work. The mechanics had an unpleasant job in keeping their vehicles going under those conditions. The heroes of a modern expedition, if there are any, are the mechanics, who have the rotten job of handling machinery under conditions of extreme cold. Ours put up an extremely fine show and I am grateful to them. One evening on the ice sheet, the day's work having been finished, the seismic team's mechanic was just starting his Weasel. When he pressed the starter button an odd noise came from the engine. He was wondering what was the matter when suddenly there was a violent explosion, the cab blew off, and the machine burst into flames. There were nearly 30 gallons of petrol on board, and the tank had split. The mechanic was lucky not to have been seriously hurt or burned. That was the end of another Weasel, and both teams now had only two, which was one too few. I was concerned about their condition as we relied on the two seismic Weasels to evacuate the North Ice crew to base, some 400 miles away. The two remaining Weasels kept going until they reached the edge of the ice sheet where one broke down 12 miles from home. The other staggered to the edge of the ice sheet and then broke a track only two miles from base. The gravity team had similar experiences and their two Weasels also only just succeeded in getting the team off the ice sheet.

I should like to say a word about the scientific results. The scientists, when they got back, had up to two years' work in front of them, but what they have told me so far is roughly this. The Greenland ice sheet has been in existence for at least 400 centuries. Along the 78th parallel of latitude the ice sheet rises to a maximum altitude of 8,500 feet at longitude 44° west. There the ice thickness is approximately 9,100 feet, so that the bottom is well below sea level. In the central part of the ice sheet, between 36° and 52° west longitude, there do not appear to be any local features greater in altitude than 300 feet above the general level of the bedrock. Nearer the east side, between 28° and 30° west longitude, there are two ranges of hills or mountains running north and south and rising to 1,000 feet or so above the general land level, and the ice sheet over them is about 1,800 feet thick. It was over those buried ranges that we found many crevasses.

I have already mentioned that by digging a pit at North Ice they got back to snow strata of 1877 at a depth of 50 feet. The average annual accumulation was equivalent to five inches of rain, and this did not vary very much until the 1920's; thereafter it decreased, so that by 1940 it was little more than two inches. Since then it has increased, until it is about four inches today. Greenland is virtually an Arctic desert. The length of Britannia glacier by the end of the Summer had been reduced by about 50 yards, due to icebergs breaking off, and its upper surface was lowered seven feet by melting. That glacier is definitely getting smaller.

This brings me to the end of the story. Last Summer, flying boats landed again on the lake and picked us up with our stores and scientific instruments and records. We could not afford to bring out much more. The whole party was once more airborne and bound for home. As we flew back to our homes and families, which some of us had not seen for two years, we were conscious—some of us, at any rate—that we were leaving behind a part of ourselves in Greenland. My final thoughts on leaving the country were a curious mixture of sadness and relief. I may sum my feelings up as follows. The Snow Queen is an exacting mistress, austere but very beautiful, whom none of us will ever forget and whose call some of us may one day answer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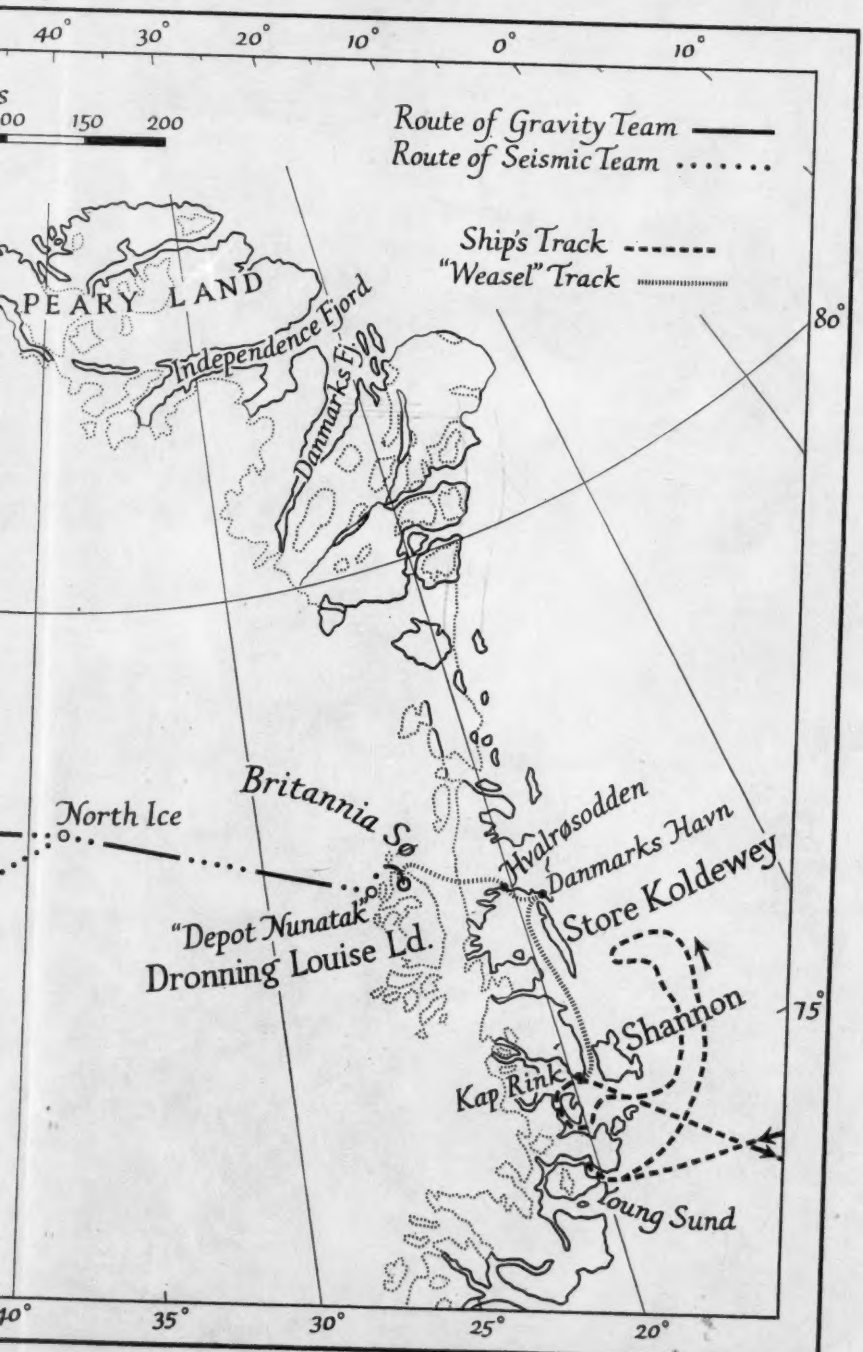

again. I cannot forget our two huts; I hated shutting the door and leaving them. The snow will have drifted over them since, but both, the base hut at Britannia Lake in particular, are well built and should last several years yet. Perhaps somebody, some day, will take up the trail again and live at Britannia Lake. I hope that they do, because they will certainly never regret the experience.

THE CHAIRMAN: The hour is rather later than is usual with us. We shall have no discussion or questions; I think that the lecturer has had quite enough.

Many years ago in a foreign capital I attended a lecture by a British officer on a South Polar expedition. It was a large and fashionable gathering, and the chair was taken by the British Ambassador. At the end of the lecture he turned to the lecturer and said, "You appear to know a lot about it." The lecturer replied, "Well, I have been there three years." "Been there three years?" said the Ambassador. "Oh, you've come back? I thought you were going." It was not the lecturer's fault!

Commander Simpson has given us a very good lecture. He has been there, and from the enthusiasm with which he spoke I have a feeling in my bones that he is going back.

There are two points that I want to talk about. The first is the value of these expeditions. I am sure that no officer of any Service who goes on an expedition such as this, and who goes through all the trials and troubles that he will experience, can fail to come back a better officer; and, even in these days of science, it is the character of the man which is predominant in value in war as in civil life. We should be glad, therefore, to see the Service Ministries taking a greater interest in this sort of thing. As for the money, we know that money can be found when it is wanted, and this nautical Nation should be able to carry out these expeditions and train its officers.

With regard to the money, I do not suppose that anybody here will take up the lecturer's request for £2,000, but you can help indirectly by going to see the exhibition in the Army and Navy Stores, and which is going to be on view at Selfridges. The more people who go to see it the more likely it is that firms will be interested and may find a little money.

Commander Simpson has given us a long talk, very well illustrated, and in your name I thank him very much indeed. (*Applause.*)

ENGINEERING IN EXTREMIS[1]

By Major J. E. L. Carter, M.B.E., M.C., A.M.I.C.E., R.E.

As the development of nuclear weapons proceeds, and with it the study of nuclear warfare, it becomes increasingly clear that the military planner nowadays cannot avoid being concerned with three types, or perhaps more accurately three levels, of war; the cold war, the chromium-plated war, and the broken-backed war. The cold war is a present fact; and economically and militarily it is the foundation from which the others must develop, if they develop at all. Chromium-plated warfare may be defined as controlled warfare of the type which carried 21 Army Group and our Allies to victory in 1944–45. Broken-backed warfare, arising from the overwhelming impact of nuclear weapons on the home base and the communication zone, may be the crude reality which in fact prevails.

A dilemma is evident. The very immensity of the nuclear threat in some way reduces the chances that it will be applied. But however small these chances are, it is certain that all practicable preparations for nuclear war must be made. Military planners have never been faced before with this extraordinary necessity of preparing for two such utterly different types of war, within the framework of a third one; particularly as they know that the change from one type of war to either of the others could proceed with all the speed and facility of a transformation scene in a nightmare pantomime.

The object of this paper is to discuss some of the engineering aspects of this dilemma, and their general relationship to the equally acute problems facing the other components of our defence forces, with the aim of arriving at certain practical steps which might be taken towards avoiding defeat as an additional horror of a nuclear war.

First, it must be accepted that if any future war became a nuclear war, in the sense of a number of nuclear weapons being used by both sides, it would inevitably degenerate almost immediately into broken-backed warfare; that is war in which the rising tide of tasks overwhelms the resources available for carrying them out. Secondly, it is clear that the development of nuclear weapons, in which a miss of a mile is as good as a hit, puts an almost unimaginable strain on a man stationed at a potential point of attack. Therefore in broken-backed warfare the dominating factor will be the morale of the man. The collapse of morale under the fact, or even the threat, of atomic attack could be the most potent factor in the destruction of an army or a country. Without adequate morale, no other factor is of consequence. Engineers, in common with others, may find themselves called upon to work for long periods in target areas. Therefore it is certain that the means of maintaining morale require the closest attention at every level, bearing in mind that the soldier will be influenced partly through his own experiences, and partly through the real or imagined experiences of other people, including his family at home. For the western world a fundamental issue in such a war will be the survival of Christianity, and it may well be that the force of faith will be the ultimate force in the maintenance of morale.

Engineering is a method of applying certain resources to certain purposes. These purposes are engineer tasks. The resources are primarily men, machines, and materials. Providing that morale is maintained, their application is a matter of

[1] This article is based on a longer, illustrated article of the same name by the same author in the *R.E. Journal* for March, 1955.

planning and organization. Engineer effort applied over a time produces work. Time, too, is an engineer resource. The total amount of work which can be produced from any given resources clearly has an ideal limit. The actual amount may fall far below the ideal. Wastages can arise from bad planning or poor organization, as well as from low morale. Work can also be wasted in advance if resources are wrongly related to the tasks likely to be encountered; or, at the time, if they are applied to tasks which make inadequate contributions to the main aim. Streamlining an army for nuclear war does not necessarily imply a streamlining of engineer tasks. So the study of engineering for broken-backed war, that is of engineering *in extremis*, becomes an art, the art of the impossible. Like all arts it must be understood to be appreciated, and like modern art its understanding and appreciation cannot be based on the convention of the past.

In essence, therefore, engineering *in extremis* must be a desperate effort to balance engineer resources and tasks, or at any rate to keep them sufficiently within balance to prevent an utter breakdown of military effort. It is essential, therefore, to study methods of reducing tasks as well as of maintaining or increasing resources.

The four engineer resources, men, machines, material, and time, must have definite relationships to one another. Machines must be applicable to the tasks to be carried out, men must be trained to work with or operate the machines, and material must be effectively related to the machines and men, as well as to the tasks. Thus quality as well as quantity is an essential item in the resources sum; and furthermore, both quality and quantity must be related not only to the tasks of all three levels of war. but to the economics of the cold war and the possibilities of production in the hot.

In a broken-backed war, in rearward areas the main engineer tasks will be the maintenance and new construction of communications, accommodation, power sources, and general utilities; work connected with protection, rescue, and radiological decontamination; and many miscellaneous items. All will probably have to be carried out in circumstances of considerable confusion and of personal distress of body and mind. In general, the conditions of wholesale destruction, and the inevitable losses in engineer resources, coupled with the requirements for merely keeping things going, will seriously limit the possibilities of new construction.

Effort will be required on the largest scale for the maintenance of movement by road, rail, and sea. The wide dispersal of airfields and their general independence of built-up areas suggests that they may represent a lesser source of demand on engineer maintenance resources. On the other hand the destruction of major ports and their associated communication and storage systems will require effort to be concentrated on developing minor ports. This must lead to a general adoption of open roadstead working, with lighters, landing craft, or amphibians used between ship and shore. In particular the destruction of oil ports, refineries, and bulk oil storage will lead to immense demands for temporary ship-to-shore lines for tanker discharge, and also for rapidly constructed bulk fuel storage on shore. These trends, coupled with the destruction of inland communication centres and the wholesale movements of population and industry, will add vastly to the problems of moving and storing food, fuel, raw materials, and military stores. Complex and urgent electrical and mechanical problems will arise. Further complications will follow as efforts are made to disperse military installations to avoid the consequences of further attacks.

In such conditions road transport will largely replace rail; and air transport dispensing with the bottle-necks of ports, railway junctions, and road centres, will naturally be called upon to play a big part. Yet, with serious overall deficiences of transport, and the difficulties of aircraft production in such a type of war, it is clear that the admitted advantages of aeroplanes and helicopters must not be allowed to draw attention too far from the vast existing tonnage-carrying capacities of ships, trucks, and railway trains.

Having assessed briefly the immense potential increase of engineer work in rearward areas it is disconcerting to find a similar potential increase in the forward ones. This has led to a recently published suggestion[2] for the formation of special engineer units at army level to undertake as a main task the opening up of routes for field formations in atomic warfare, on the grounds that normal field engineer units, owing to lack of equipment and appropriate training, would be unable to cope with such tasks. The problem is real, even though the particular solution suggested may be impracticable. Chromium-plated warfare demands heavy tanks, heavy bridging, heavy transporters and recovery vehicles, heavy workshops, heavily equipped assault engineers, and an immense logistic tail. It also, at present, demands high-performance jet fighters with their associated engineer-backbreaking demand for acres of level and thick surfaces of steel, concrete, or stabilized and surfaced soil from which to operate. The immensity of the engineer load imposed by modern heavy armour and aircraft is only equalled by their logistic effects on other services. Unless this load can be carried by the tail the teeth cannot bite; in fact it may be said that for any given conditions of war and types scales of equipment there is a definite economic relationship between the strengths of tail and teeth. It is easy to avoid these issues when planning an army on paper, and not too hard even in exercise conditions, when imagination and kindly umpires can combine to boost a fighting force over some of the imponderables which are not so lightly dismissed in the actual event. In fact, in war, the tail has got to be strong enough to wag; if it doesn't the teeth can't bite, and, to quote Gilbert, " that's the long and the short of it."

It is not for engineers to say how engineer tasks should be lightened, but it is pertinent to point out that there is a limit to engineer effort, and that this limit may be reached remarkably rapidly in the early stages of nuclear war. Reductions in the weight of armour, in the number of routes on which it is deployed, and in the requirements for new heavy airfield construction are three main ways in which combat equipments and methods can contribute to the lightening of engineer tasks. Thus, on land the ability to continue fighting on a sudden change from chromium-plated to broken-backed conditions may depend on establishing and maintaining sufficient flexibility of mind and organization in convential fighting formations to be able to reorganize to scales of whatever lightness is needed to maintain combat effect. In short, if two sides are on the verge of logistic and moral collapse, the one that can summon up some sort of vehicle or airborne attack is likely to carry the day in the field.

In the air the solution seems to lie in sacrificing some air performance, of at least one type of fighter, in exchange for an ability to operate off the simplest and most strategically mobile types of airfields. This, apart from world-wide airfield construction in peace-time for use in the withdrawal or defence, seems the only way in which

[2] *Speed and Surprise in an Atomic War*, by Major M. L. Crosthwait, R.E., the *R.E. Journal*, June, 1954.

reasonable strategic mobility for some part of the tactical air force can be achieved. Vertical take-off, catapulted and arrested aircraft, and utility fighters such as the Folland Gnat all conform to this principle, but unfortunately are far from being available in any quantity. At present, fighter specifications, with all the priorities they carry, approximate to irresistible forces, but it is as well to remember that in the conditions of broken-backed warfare, the task of airfield construction for them may be something in the nature of an immovable object.

No one will feel inclined to throw overboard now much of the finest, most effective, and incidentally heaviest and most expensive equipment of our land and air forces. Yet is seems certain that we must be prepared to do so at short notice if conditions require or impose a change from chromium-plated to broken-backed war. Engineer and other logistic resources might then be released for the support of the light fighting elements of the formation; operations might then continue in the manner of the later campaigns in Burma and the Far East, with lightly equipped and largely air supplied forces operating in support of atomic power in the atomically created logistic jungles of the western combat zone.

In the communication zone much can be done to lighten the engineer load by the development of modern material-handling methods, with particular reference to mechanical-handling methods suited to bad ground conditions, and to the use of storage and handling techniques which require the minimum of roads, hardstandings, and covered accommodation. In addition, improvements to ships' gear, coupled with the use of mobile quayside mechanical-handling equipment and improved types of stores-handling lighters and landing craft, and with the introduction of carefully thought out methods of stores-loading in parcels, on pallets, inside containers, or on through-travelling trailers, can substantially ease the problems of port operation in a broken-backed war. However, at present the division of responsibility for the provision and movement of military material between engineers, ordnance, R.A.S.C., and a host of other military and civilian agencies makes it extremely difficult to take advantage of new machines and methods. Co-ordination through multitudinous committees is a poor substitute for control under a unified command. Supply, storage, movement, and maintenance are four basic activities associated with military material. Can it be said that British organization adequately reflects this fundamental fact? Unfortunately it is widely believed that somehow the teeth of an army can be strengthened by either neglecting the tail, or by subjecting it to a process of optimistic though unenlightened attrition, euphemized in the phrase 'streamlining'. In fact, the tail has to be designed to do its job, no more and no less. Can it be said that this is yet on the way to being the case in the British Army in relation to the administrative problems of broken-backed war?

So much for suggestions on lightening engineer tasks. Even if all were adopted and yielded results of the greatest significance, it is clear that the engineer tasks in a broken-backed war would still be overwhelming compared with those of any previous war, and that the main portion would lie in rearward areas. It can also be seen in terms of brute effort that the major part of the gross engineer task would be the movement or clearance of earth or debris; digging in various forms for protection, rescue, and the restoration of services; the repair or provision of wheel-bearing surfaces such as roads, airfields, quaysides, or other areas needed for the handling or stacking of stores; bridging; and the production and erection of low-standard accommodation. In terms of skill much effort would be required in connection with water supply, bulk fuel supply, electric power and light, port and railway

construction and operation, and countless smaller tasks, as well as the skilled elements of the major effort-consuming activities listed above.

It follows, therefore, that the development of engineer resources in preparation for this type of war must be related to these types and scales of tasks, and must take proper account of the potential requirements of the base and communication zone. Furthermore, it must be remembered that the effect of nuclear attack may require the merging of civil and military engineer resources in a target area to an extent which was never needed in the last war.

The inescapable conclusion is that men can be made available for the tasks men must do only if machines are used for the tasks machines can do.

Machines for engineer purposes can be divided roughly into three categories according to their size, complexity, and cost. Large machines such as bulldozers and excavators have a well-known role in road and airfield construction. Small machines such as mechanical picks and shovels have established uses in the hands of men. There is, however, a less well understood middle scale, where large machines are uneconomic in every sense of the word and small ones are ineffective. A very large number of field engineering tasks lies in this scale, particular examples being excavations for weapon pits and small shelters, many bridging tasks, most stores handling, some aspects of debris clearance, and many miscellaneous tasks which in sum absorb a considerable proportion of the total engineer effort.

This is also the case in the civil world and, following on the extensive development of the agricultural tractor and associated tools for tasks of this scale in agriculture, there has been a considerable development of the same tractors and similar tools for use on building and light engineering construction. This latter type of development has made real progress only in the last three or four years and has opened up a remarkable new approach towards solving the problems of mechanizing military engineering and similar types of military effort.

The basic machine, the wheeled medium agricultural tractor, is simple, cheap, durable, and in mass production. In 1951, the peak year of post-war tractor production in Britain, 133,644 units of all makes were produced. The current rate of production of Fordson Major tractors alone is about 46,000 a year. At present there are about 360,000 agricultural tractors in use in Great Britain. So it can well be appreciated that behind the agricultural tractor there is a substantial trained manpower of designers, producers, operators, and mechanics, as well as enormous production resources directed towards turning out thousands of machines a month at the lowest possible cost. It is true that the Army makes some use of these machines (mainly for the upkeep of playing fields); but on the whole the Country's potential annual output of 4–5,000,000 horsepower in this type of machine, is, for military and defence purposes, a largely untapped reserve of readily available, mobile, mechanical power.

Agricultural tractors are mass-produced and, apart from certain standard variations which allow them to be adapted to other uses in certain ways, no variation in primary design is possible. It is, however, the practice for a number of smaller firms to take the mass-produced primary units and turn them into a variety of machines. These may conveniently be described as tractor-based machines, and combine the advantages of mass production for the major parts of the machines with those of the special features introduced by the modifications. Tractors or tractor-based machines can also be used to tow various appliances or operate a wide range of tools.

Among the existing commercial tractor-based machines are now to be found hydraulic excavators of considerable cross-country speed and mobility, and capable of digging any military hole as fast as 12 tireless men ; cross-country forklift trucks capable of carrying loads of a ton and a half ; cross-country bulk loaders capable of filling trucks with road material and of helping to clear debris ; and many other machines of more specialized type. With ancillary appliances these machines could be used to dig holes for laying mined charges in a withdrawal, for operating pumps for fire fighting and decontamination, for supplying compressed air for pneumatic tools of all kinds, and for driving saws for forestry or drills for demolition or quarrying. New tools and types of machine are continually appearing, as are also new ideas for the use of current models.

The average cost of this type of machine runs to about £1,500, so that 10,000 machines, representing about seven and one half per cent. of the potential tractor production capacity of this Country for one year, could be purchased for about £15,000,000. These machines, applied to defence, would still be only about three per cent. of the number of similar machines applied to agriculture, and would be equivalent to a labour force of something like 120,000 tireless men available for the more menial engineer or associated tasks of the broken-backed war. The fuel the machines needed would cost far less than the food for the same number of men. The maintenance of the machines would be far less of a problem than the medical maintenance of the men. The machines could work indefinitely in radio-active areas without suffering from radiation sickness. Under the threat of atomic attack a few operators would be easier to control and relieve than a very much larger labour force doing the same job by hand.

The problem of digging-in modern formations is much greater than is generally realized ; particularly if many vehicles are involved, or in units such as headquarters, medical units, and workshops where the majority of the men have vital duties which they cannot readily neglect. To give a division really effective assistance at digging-in within two days of a move, something like 50 to 100 machines would be needed. A case at once develops for forming corps units of diggers consisting of perhaps five platoons, each of 30 machines. Sub-units of this size would be able to move 100 miles in eight hours without any need for transporters, and could supply assistance of incalculable value in dealing with atomic incidents in the communication zone. In the home base they might provide the hard core of military columns operating in aid of the civil authorities. In more active operations similar machines might be used to assist battalions in consolidating after carrying out a successful attack, either by land or air.

While it is clear that many machines of this type would be needed by engineers and might be held integrally within the engineer organization, it is not felt that corps digging and humping units of the type suggested should be engineer units. They would clearly be in the nature of mechanical pioneers ; although in many types of work, such as the digging-in of a division, their activities might well be co-ordinated by the engineer commander and his staff.

It will be argued at this stage that this suggestion is against the principles of streamlining ; that what is wanted is fewer machines, not more. The real question, however, is whether teeth and tail are properly balanced so that each can play an effective part in the many possible conditions of future war. The inexorable facts that the planner must face are the impossibility of fighting a chromium-plated war on a broken-backed logistic system, and the impossibility of developing an adequate

logistic system without an adequate expenditure of thought and resources. An interesting analogy lies in the catastrophic electrical failures in early post-war years owing to uncontrolled load-shedding due to lack of power station capacity, and the remedies involving systematic load-shedding when necessary, coupled with the systematic though slow building of new stations.

Machines, however, are useless without men who can operate them and staffs and commanders who understand their use. Operators, staffs, and commanders must be trained, and this unfortunately cannot readily be done on paper. Machines can be developed through a series of slowly changing prototypes, but this type of development contributes little to the development of methods or the training of men. For this, machines must be available in more than token quantities. It can also be well appreciated that there may be some delay in producing any machines which are not actually in existence at the outbreak of nuclear war. Fortunately, however, machines of this type can to some extent earn their keep in peace, and in contrast to many other types of military equipment, will always be of full value regardless of whether better types are developed by ourselves or our enemies. It seems reasonable, therefore, that adequate numbers of machines should be provided now from existing commercial sources.

In this paper there have been suggested several ways of lightening the loads on engineers *in extremis*, and one economic way of putting more resources at their disposal. It may be as well to remember also that in a broken-backed war each side may bludgeon the other into a state of military insensibility in a matter of weeks, if not days. Such a war, however sour, may be short. Engineering *in extremis* will then turn to engineering in the aftermath ; and the resources, which in the former, may have been used only for a fortnight, in the latter may prove of untold value for 20 years.

YE MARINERS OF ENGLAND—I

By Major Reginald Hargreaves, M.C.

> "Providence made man to live ashore,
> and it is necessity that drives him to sea."—
>
> Bishop Williams.

THE English dearly love to think of themselves as a seafaring people. The rollicking, nautical ditties of Charles Dibdin form part of our musical heritage and nothing but acclaim greeted the poet Campbell's thrasonical quatrain,

> "Ye mariners of England!
> That guard our native seas;
> Whose flag has braved a thousand years
> The battle and the breeze."

What is so frequently overlooked, however, is that time and time again, over the centuries, the authorities concerned experienced the very greatest difficulty in manning the vessels upon whose activities England's reputation as a maritime power was founded.

When, in the IVth Century, B.C., Pytheas, the Greek mathematician and astronomer, made the first trip of all across the narrow seas to explore *Clas Merdin*,[1] he found a primitive agricultural and pastoral tribal community whose only maritime activity took the form of a little inshore fishing.

They had altered little by A.D. 872 when the Saxon King Alfred was forced to realize that the only way in which to deal with the invading Norsemen was to meet and defeat them before they could set foot ashore. But neither navies nor shipmen can be brought into being overnight. So it was with the aid of experienced Frisian shipwrights that Alfred constructed those "long ships, . . . full nigh twice as long as the others,"[2] with which he hoped to wrest the dominance of the narrow seas from the Viking flotillas that hitherto had sailed them unchallenged. Moreover, it was necessary to stiffen his inexperienced crews with a generous quota of veteran Frisian mariners.

Alfred brought a people of tilth and pasture to an awareness of the sea as a vital element in their destiny; and during his own and succeeding reigns a race of native deep-water seamen came slowly into being. But its numbers were small, despite attempts to organize the maritime resources of what presently came to be known as the Cinque Ports. The obligation undertaken by the five havens of Hastings, Romney, Hythe, Dover, and Sandwich, together with the two 'antient towns' of Winchelsea and Rye, to furnish the King with 20 ships for 15 days, "once in every year," was complicated by the difficulty of manning each and every vessel with a minimum crew of 21, as the law decreed. The need for seamen—almost any kind of seamen—was reflected in inland Warwick's liability to furnish four *marinelli* for

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[1] Literally, "the sea-defended green spot," the name by which Britain was first known.

[2] Saxon Chronicle.

the King's service, or pay a fine of £4.[3] Yet for all the shortage of fully-qualified seafarers, there was no resort as yet to any nation-wide system of impressment.[4]

With the threat of a Norman invasion hanging over the country in the mid-summer of 1066, Harold Godwinson was forced to supplement his few professional butse-carls with a number of part-time sailors, fisherfolk, and the like, called up for the emergency. August saw the Saxon fleet assembled between Sandwich and the Isle of Wight, awaiting the Norman's attempt to cross *La Manche*. And as the weeks passed they continued to stand by; for contrary weather held William of Normandy pinned to the harbour of St. Valery. It was not until the 18th September that the wind veered to blow steadily from the south-west, speeding the Bastard of Falaise upon his way, to land, unimpeded, at Bulverhithe. Harold's guardian fleet had abandoned its watch and ward over the narrow seas, " for the season of provisioning had begun, and no man could keep them there any longer."[5] In effect, it was the season of the year when the majority of the cattle was slaughtered, salted down, and barrelled for consumption throughout the Winter; for only a tithe of the beasts could be maintained till the following Spring, for want of the necessary root crops on which to feed them. This Autumn battue, together with the demands of the harvest, were obligations not to be neglected by Harold's part-time mariners, with the result that the invasion force was free to land and establish its bridgehead unchallenged and unmolested.

No one had better reason than William of Normandy to appreciate that without a guardian fleet abroad in the narrow seas, England lay wide open to invasion. But the lesson was never brought home to him, since throughout his reign, and those of his five immediate successors, the Channel was no more than a vexatious ditch separating the Sovereign's island realm from his possessions on the continental mainland. A ferry service across the waterway was provided by the Cinque Portsmen—confirmed in their privileges and obligations by special Charter[6]—supplemented, should the necessity arise, by merchant craft ' arrested ' for the King's service. In the prevailing circumstances, therefore, there existed a sufficient seagoing population to meet any demand likely to be made upon it. It was not sufficiently numerous or well-organized, however, to free the narrow seas of those maritime freebooters who had made *La Manche* their happy hunting ground.

Affairs assumed a very different complexion when King John's accession to the throne was followed by the loss of Ireland, Maine, Anjou, and the greater part of the fiefs brought to Henry II by his consort, Eleanor of Aquitaine. In a politico-strategic sense, for the first time since the Conquest, England became an island; and the ' ditch ' was transmogrified into a salt-water barrier against Gallic aggression. The only problem was how, in a naval sense, it could best be manned.

[3] In spending value the equivalent of about £75 today.

[4] Etymologically, the terms ' press ' and ' impressment ' have nothing to do with forcing unwilling men into a Service they are reluctant to join. The word ' press ' is a corruption of ' prest '—the ' prest ' or ' imprest ' money that was paid as a token of wages due from the Sovereign, analagous to the acceptance of ' the King's shilling.' The terms are employed throughout, however, in the connotation which has come to be associated with them.

[5] Saxon Chronicle.

[6] The Charter granted to the Cinque Ports by Edward I in 1278 is the oldest document to have survived; but it is implicit in its phraseology that it was preceded by several earlier deeds.

Under Richard Lionheart's ' Rules of Oléron ' the seaman had been endowed with a charter in which his privileges were as carefully defined as were his obligations. By contemporary standards, his status and terms of service—with 6d. a day for the *rector*, or shipmaster, and 3d. a day for the ordinary seaman, with a stake in any prize captured—left little to be desired. Yet even with the inducement of good wages and the prospect of prize, it was necessary to take advantage of the feudal law which authorized impressment, to secure all the men needed for the King's service. For with the Channel ports of the continental mainland in hostile hands, the 50-odd galleys of the Royal fleet had to be supplemented by a number of merchant craft, ' arrested,' together with their crews, as an extraordinary measure of precaution. The names of the vessels scheduled for ' arrest ' were displayed at every port on cartels—scrolls pegged to a gatepost or fastened to the tip of a spear. Hard by, clerks and scriveners registered the particulars alike of volunteers and conscripts; while female labour was recruited for the fabrication of extra sails. It was with a fleet brought into being under these conditions that the Earl of Salisbury raided the enemy shipping concentrated at Damme, in March, 1213; an action in which the *marinelli* bore an exceedingly active part. For although it was the foremast hands' prime duty rather to ' work ' their ship than to ' fight ' it, when it came to hand-strokes they vied zealously enough with the soldiery aboard in pressing home the attack. At the battle off Dover, of August, 1217—the first ' battle of manœuvre ' in which English ships engaged—it was the *marinelli*, deftly manipulating their long-handled rochets, who brought down the Frenchmen's sails, to envelop the enemy sailors and men-at-arms in the heavy, canvas-backed silken folds " like a net upon ensnared small birds."

Edward I made liberal use of impressments to man his craft, although it was left to Edward III to compile a general list of all those who followed the sailor's calling, whether in ocean-going merchant craft or in the fishing or coasting trades.

It was to the fisherfolk that the English kings invariably turned to make good any shortage of man-power in the Royal ships. With their trawling grounds perpetually infested with pirates and enemy raiders, they had learned the ways of the sea and of combat in an exceedingly hard school and they could always be relied upon to give a remarkably good account of themselves in action. The difficulty lay in persuading them to exchange their prosperous commercial activities for service that might be more exalted, but was certainly less lucrative. For in mediaeval days the harvest of the sea was in perpetual demand, and war-time meat rationing, such as was imposed by Edward III in 1353, served even further to increase the market for fish which, salted and barrelled, was taken by pack train even into the remotest countryside. Men engaged in this profitable traffic were loth to exchange it for a service more conspicuous for hard knocks than hard cash.

With the shortage of seamen which followed on the visitation of the Black Death in 1348–49, the demands for higher wages—like the price of fish—went to such preposterous lengths as to call for regal interference to curb the shipmen's soaring cupidity.[7] With France and England almost perpetually at war and the outpost of Calais to be maintained, the mariner was keenly aware that he was in short supply, and it was only human to try and take advantage of the fact. The King's *riposte* was to resort to wholesale impressment; the little township of Plimeut (Plymouth) yielding more men, oddly enough, than the thriving port of London.

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[7] See 23 Edw. III, Cap. III, Cap. IV and Cap. VIII; 25 Edw. Stat. I, Cap. 1.

The Navigation Act introduced by Richard II in 1381[8] embodied provisions which ensured that English wool and wool-fells should be transported overseas exclusively in English bottoms, manned by predominantly English crews. But this enactment, while significantly enlarging the scope of the mercantile marine, at the same time made it abundantly plain that the demand for experienced English hands would substantially exceed all possible sources of supply. In the outcome, insufficiency of native-manned English bottoms to carry the freight led to such a number of ' permissive amendments ' in favour of foreign shipmasters as virtually to stultify the Act's praiseworthy intentions.

There were just not enough English shipmen to fill the bill. For with the gradual but unrestrainable silting of their harbours—on top of all the injury inflicted on them by the French—the Cinque Ports were in rapid decline ;[9] while Portsmouth, Southampton, and the more westerly ports were not yet in a position to make good the shortage of seafaring man-power which persisted elsewhere. Thus the Country's enemies were free to lord it in those narrow waters over which every King since John had professed to claim dominion as ' Sovereign of the English Sea.'

With the death of Henry V, the Council of State, which held the reins of power throughout the minority of his successor, manifested its political sagacity by selling off the majority of the Royal vessels so laboriously acquired in the previous reign. Shipmen who had hitherto manned the Country's warships found eager acceptance when they applied for work aboard the expanding fleet of merchant craft ; some of which now took their merchandize as far as Lisbon. But the Country's first line of defence was so impoverished that the guardianship of the entire Hampshire coastline, for example, was confided to the ' ballinger of Clifton,' known as the *Jacket*, whose crew totalled a mere 40. In the end, the Council of State was driven to the disgraceful expedient of trying to police the Channel with an ' indenture fleet,' which contracted to ' keep the sea ' for a specified period, usually between February and mid-November.[10] Since service with the ' indenture fleet ' was remunerated at the rate of 1s. 6d. a week pay, with a further 1s. 6d. victualling money—both forthcoming with unusual punctuality—there was no lack of shipmen to man it ; although many of the hands were foreigners. Private enterprise, however, can never be a satisfactory substitute for national responsibility ; and in this instance it entirely failed its trust. The pillage of merchantmen not strong enough to defend themselves continued unabated, Danish freebooters alone accounting for the loss of merchandize to the value of £20,000 in one year ; while the activities of the ' indenture fleet ' itself amounted to little more than piracy legalized by success.

Although the Monarch cannot be held as other than blameworthy for this sorry state of affairs, it has to be borne in mind that it was considerably easier for a Sovereign to ' live in his own '—i.e. provide for the Country's defence out of his personal resources—in the days of cheap feudal levies,[11] than in times wherein everyone enrolled in the national cause had to be paid and subsisted out of ' the

[8] 5 Richard II, Stat. I. Cap. 3.

[9] Hythe, for example, had been so ruined by pestilence, enemy action, and the silting of its haven, that it took regal intervention to prevent its total abandonment.

[10] For a brief period during the reign of Henry IV the Merchant Adventurers had contracted to ' keep the sea ' between the 1st of May and the 29th of September with an ' indenture fleet.'

[11] Mediaeval forces, it will be recalled, were self-supporting for the first forty days of a campaign, a period subsequently extended to three months.

King's hoard,' from the very outset. Since by long-established custom the deck hand of the mercantile marine could ship a certain amount of cargo with which to trade on his own behalf, service in ' commerce ' was far to be preferred to toiling and moiling in the Sovereign's war vessels.

The problem of regal ways and means, and all it connoted, went unsolved until the accession of Henry VII ; an individual who was not only an extremely competent Monarch, but a remarkably shrewd business man. Fully alive to the preponderant part to be played by the sea in his Country's destiny, he not only sponsored a subsidy for merchant shipping, and in the *Regent* built a vessel to accommodate a ship's company of over 1,000, but saw to it that the terms he offered his mariners were of a liberality to render seafaring an attractive calling, especially in the Royal service. With the spending value of money very largely restored, pay ranged from 10s. a day for an admiral to 1s. a week, ' with vittels,' for the ordinary seaman when in harbour, rising to 1s. 3d. when actually at sea.[12]

A firmly enforced Navigation Act enhanced the demand for native seamen, but the call was met without resorting to widespread impressment. ' Sturdy rogues and vagabonds ' and ' poor masterless men ' were not, as heretofore, automatically regarded as the raw material out of which seamen might somehow be fashioned ; but that prime source of supply, the fishing fleet, was given every encouragement to expand and multiply.

Bluff King Hal had all the ' awareness ' with regard to matters maritime which had characterized his Royal sire. At his instigation the first English ships designed exclusively for purposes of war were put under construction. Thereafter, stimulated by the fact that the coast of Brittany had passed into the hands of the hostile Francis I of France, by the early Spring of 1514 Henry contrived to assemble a fleet of 23 King's ships and 21 hired, and refitted, merchantmen, supported by 15 victuallers, and manned by 3,982 seamen and 447 gunners. The majority were volunteers ; but their discipline, alas, left a good deal to be desired. For when the French attacked Dover later in the year, the Crown ships lay idle at their anchorage, their crews having endowed themselves with leave to go ashore in a body.

With the war with France gathering momentum in 1545, the estimates legislated for 5,000 men, whom it was thought would be " brought in with some dyffycultie."[13] But they ' tumbled up,' both sailors and gunners, knowing that they would qualify for a flat wage of 5s. a month, with subsistence, and a right to certain ' dead shares,' and confident that they would be paid with exemplary punctuality.

Henry's shipmen responded just as eagerly, and fought just as manfully, in the final bout with France in 1546.

With his death in 1547, Bluff King Hal's legacy to his Country included a properly constituted Navy Board and a fleet of 53 Crown vessels of over 500 tons burden, and 37 other craft of over 200 tons—all of them fully manned.

Yet so quickly do the conditions of the sea-service deteriorate under faltering guidance, that by late 1548 Edward VI was hard put to it to remedy the chronic shortage of seamen. With a view to enlarging the pool of fisherfolk, an Act[14] was

[12] To obtain a rough idea of the contemporary spending value of money, multiply by twelve in each instance.

[13] If dissatisfied with the conditions of service in his home ports, the English shipman could always be sure of welcome in a foreign craft.

[14] Edw. VI, II and III Stat. I. Cap 19. The penalty for non-observance of this ordinance was a 10s. fine or ten days' imprisonment.

introduced which ordained that " no person or persons . . . shall willingly and wittingly eat any manner of flesh . . . upon any Friday or Saturday, or the Embring Day, or in any day in the time commonly called Lent, nor at any such other day as is or shall be at any time hereafter commonly accepted and reputed as a Fish Day."

This was endeavouring to force the issue with a vengeance; but there was scant improvement in the situation during the reign of Mary—when Calais was lost for want of a proper naval force for its support—or until the Elizabethan era had got fairly into its stride.

Elizabeth's was the reign of the merchant-venturer, accustomed to small flotilla warfare, if unschooled in comprehensive fleet actions. His ship's company consisted of gentlemen-volunteers and professional seamen. With the last-named he entered into articles which ensured that all hands were well-paid, generously fed, and assured of a fair share in such profits as their voyage might earn. Skilled seamen and admirable gunners, under leaders like Drake, Hawkyns, Howard, Frobisher, Raleigh, and Grenville, they formed the hard core of the fighting fleet that eventually turned the issue in England's favour in her quarrel with the Spaniard. An additional school of seamanship—and war—was to be found with those captains sailing under Letters of Marque or Reprisal; leaders such as Champernowne, Killigrew, Carey, Horsey, and Oglander, who preyed on all Spanish shipping venturesome enough to attempt the passage of the narrow seas.

Further stimulus was given to the cross-Channel trade by the enactment which permitted the export of fish free of customs' dues so long as it was transported in English bottoms, manned by predominantly English crews. Thereafter, " to encourage ship-building and increase the breed of mariners,"[15] Elizabeth went one better than Edward VI, by adding Wednesday to the weekly Fish Days already in the calendar. A register of shipmen was maintained, which, incidentally, reflected the rise to importance of the west, where Devonshire listed 1,100 men against the 342 of Hampshire.[16]

Despite these heroic measures and the genuine increase in the seafaring population which characterized the reign, it was still necessary to resort to impressment to man a steadily-expanding marine. One of the first acts of John Hawkyns, on his appointment as Treasurer of the Navy in 1577, was to take measures which would render it impossible for impressed seamen any longer to bribe their way to surreptitious release. ' Pressing ' as understood by the Elizabethans, of course, bore little resemblance to the methods employed in later centuries. It was " rather a system of compulsory naval service enforced on all seamen by a kind of conscription."[17] Even so, the mariner in Crown service was reasonably well fed and remunerated—at 6s. 8d. a lunar month up to 1585[18]—with ' coat and conduct money ' from his home to his port of embarkation. For all that, it was reported that the Queen's ships

[15] V Eliz. Stat. I. Cap. V, 1 and 14. As a consequence of this enactment 51 fishing smacks were added to the register in five years.

[16] This can largely be attributed to the decline of commerce with Southampton and the concurrent increase in the fish-exporting trade from the west country havens.

[17] Corbett.

[18] In spending value, the equivalent of over £5 in present-day money. In 1588 Hawkyns sponsored an increase in wage-rates to 10s. a month. He also provided hammocks for the foremast hands.

were often so ill-manned that though they had hands enough aboard, " not one vessel in the fleet had half her complement of *good* men."[19] In 1597, Essex told the Privy Council that men had been taken up by the press-masters " in mariners' clothes, but shall not know one rope in the ship " ; while a contemporary captain complained, " We are furnished with men of all occupations, that never knew any rope, many of them, nor ever were at sea."

These complaints were voiced, of course, during the slackening-off period which ensued once the fear of a second attempt at invasion by the Spaniards had finally been dissipated.

In 1582, the register had shown 1,488 masters, 11,515 shipmen, 2,299 fishermen, and 957 London watermen as available for service, and the totals exhibit very little deviation until towards the end of the reign, when there is a sharp fall in all of them save the last-named. Lucrative voyages in trade and profitable privateering,[20] with ' gratuities ' and a share-out of prize money, had encouraged the growth of a hardy breed of rumbustious and experienced seamen ; but even so demand consistently outpaced supply. And the human material with which that hard core was supplemented was of variable but rarely high-grade quality.

* * * * *

The genuine seafarer's status has never stood higher than during the Elizabethan heyday. Its progressive deterioration thereafter was as rapid as it was protracted ; for it was not until mid-XIXth Century that the sailor regained something of the standing and regard he had been accorded under Drake and Hawkyns.

In 1599, a fairly respectable armament still could be fully manned and got ready for sea in 12 days. But by 1618 there was scarcely fleet enough to arouse the jealousy of the taxpayer, let alone the wary respect of a foreign Power. James I had neither understanding of sea power nor the nerve to employ it. It is true that divine service was held aboard ship twice a day, at the King's particular behest ; but no care was taken to ensure that wages were paid punctually, or food provided that was nourishing and palatable. Small wonder that Raleigh could write of the contemporary shipmen, " They go with as great grudging to serve in his Majesty's ships as if it were to be slaves in galleys." Impressment did little to make good the persistent shortage of hands, for the Navy Commissioners wrote despairingly to Buckingham, " the pressed men run away as fast as we send them down." Corruption was rife, and punishments were barbarous ; while any tempered respect and loyalty the shipman might have had for their King was turned into hatred by James's treacherous order for Raleigh's execution. The whole of Kent could produce no more than 442 registered seamen ; Sallee pirates lorded it openly in Thames-mouth[21] ; merchant-men " dared hardly sail," while the fishing industry, like the invaluable carrying trade, passed more and more into the hands of the Dutch. " Virtually all the Powers of the world were invited to prey on English shipping,"[22] and English shipping was in no case to hit back.

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[19] *The British Tar in Fact and Fiction*, Commander C. N. Robinson, R.N.

[20] With the idea of replacing anticipated casualties immediately, the tendency was to ship far too numerous a crew. This led to unhealthy overcrowding and the inevitable spread of disease.

[21] Between 1609 and 1616 pirates captured 466 ships, consigning their crews to slavery ; while the Muscovy Company was driven to reducing its fleet from 17 to two vessels.

[22] *The Naval Side of British History*, Sir Geoffrey Callender.

It was a legacy of distrust, neglect, and decay that Charles I sought desperately to remedy. But upsurgent political antagonism did not hesitate to make capital out of the Monarch's endeavour to restore the fleet to something like its pristine strength, and thus the refashioning of Britain's navy was handicapped at every turn.

With the outbreak of civil war in 1642, Parliament's fleet of 32 vessels—16 of which were armed merchantmen—was manned by volunteer crews strong in their faith in the 'popular' cause—and in the promise of generous treatment made them by the Council of State! But with the second phase of the struggle, in 1648, Parliament's unredeemed pledges to its seamen came grimly home to roost. So early as 1643 one disgruntled captain had written of his craft, "Never hath ship been sent to sea as we have, nor used worse than we are"; and subsequent conditions showed virtually no improvement. It is scarcely surprising, therefore, that a change of heart persuaded a considerable proportion of the fleet to hoist the Royal Standard and make for Helvoetsluys, where Prince Rupert assumed command.

From start to finish, the Royalist fleet was manned almost exclusively by volunteers. But despite the Council of State's decree raising the pay of the ordinary seaman to 19s. a month and that of the new rating of able seaman to 22s. 6d., impressment had to be resorted to on a lavish scale to keep the Parliamentary armament in commission; while 'Roundhead' troops were drafted aboard the fleet to supplement the depleted crews. Men conscripted were given 12d. 'prest money,' and 1½d. a mile 'conduct from the place where they shall be'; while there was a system for the distribution of prize money as precautiously liberal as was the new scale of diet.

But as the demands of the Dutch Wars added ship after ship to the fleet, the problem of manning the craft, aggravated as it was by dwindling funds, became progressively more acute. For the rival attractions of privateering drew away many a man whom Blake, Monck, and Ayscue would have been only too glad to have borne on their nominal rolls.

The press was no longer a haphazard round-up of such strays as might fall into the net, but subject to careful organization; the saturnine Captain Hatsell earning an unenviable name for himself by the thoroughness with which he combed Plymouth and its environs for likely landlubbers. So desperate was the need for men that semi-moribund Southampton received an order to produce 300, as did Poole and Weymouth. Even with the invaluable coastal colliers, all hands between the ages of 16 and 45 were pressed into the Service[23]; and bands of fugitives up to 40 strong fled to the woods to elude the ever-widening drag-net.

In effect, the authorities—in any case grievously handicapped by shortage of funds—were confronted with the phenomenon of too great a demand chasing too meagre a supply. It was a condition of affairs which the last half of the XVIIIth and the first decade and a half of the XIXth Centuries were to witness on even a more aggravated scale.

(To be Concluded)

[23] Fifty men of one such impressment had to be released "on account of the mighty clamour of their wives"! (Cal. S. P. Dom. 1652–3.)

LORD WARDEN

By Richard C. Stone

ALTHOUGH Sir Winston Churchill has resigned as Prime Minister, he still retains the office of which, next to his Premiership, he has always been most proud—that of the wardenship of the Cinque Ports, the ancient southern harbours inextricably bound up with the naval and maritime history of these islands.

Sir Winston has held this venerable and honourable office since 1941, and King George VI could have had no happier inspiration than appointing him to it, particularly at a time when the nation was facing the greatest crisis in its history. For by becoming Lord Warden of the Cinque Ports the Prime Minister symbolized Britain's defiance of her enemies. It is the oldest office associated with the defence of the realm, and in his history Professor Burrows gives some reasons for the lustre which surrounds it. Visitors to them now may find it difficult to visualize the ports when they were in their prime, but in the Middle Ages they developed " into a great and powerful corporation charged with the control of a principal industry and food supply of that (the English) people, the herring fishery, trusted with the defence of the English shores and the passage to the continent, gradually formed into a local Royal Navy and performing the most brilliant service, chartered by each Sovereign in turn with unrivalled privileges, honoured with the highest place above all others at Coronations, and retaining a titular rank, confined to themselves, which is not even yet obsolete."

It is not surprising, therefore, that the office of Lord Warden is regarded as one of the outstanding honours that can be conferred upon eminent men, and the names of the Wardens and the Admirals of the Ports are the great names of English history. They include several who afterwards ascended the throne, and among these were some of the most famous of England's fighting kings—Edward, Earl of Chester, the Crusader, afterwards Edward I; Henry of Monmouth, Prince of Wales, the victor of Agincourt; James, Duke of York, Lord High Admiral, afterwards James II, spoken of as " the greatest fighting seaman of the English royal house." Hubert de Burgh was Lord Warden and so was ' Steenie ' Buckingham, and Warwick the Kingmaker, by uniting the office to that of Constable of Calais, exercised a unique power over the Channel at a critical phase of the Wars of the Roses. In more modern times many other illustrious names are found upon the roll, among them those of Lord North, William Pitt, the Duke of Wellington (he died at Walmer Castle, the Lord Warden's residence, where his bed can still be seen), Lord Palmerston, Lord Salisbury, Lord Curzon, Lord Willingdon, and King George V when Prince of Wales.

The fact that Sir Winston Churchill's appointment reflected the personal wish of his Majesty King George VI repeated history in an interesting way. William Pitt held the historic office at a time closely resembling that of recent years, when Britain faced the same menace of invasion. To the end of his life Pitt refused all honours of knighthood and nobility. He even rejected the supreme honour of the Garter, but George III was not to be outdone. As soon as he heard of the death of the Earl of Guildford (formerly Lord North) in 1792, he wrote off to Pitt saying that he would be seriously displeased if any names were submitted to him for the Lord Wardenship, since he had unalterably made up his mind to confer it upon Mr. Pitt himself. That broadside completely shattered the great war minister's power to reply, and he accepted the offer. At Walmer he discussed the French threat of

invasion with Nelson, himself raised a fleet of vessels, and reviewed them under the Lord Warden's flag. Wellington, the conqueror of Napoleon, was in office almost a quarter of a century, 24 years to be exact, and he lived long enough to see the Country almost panicky about invasion by Napoleon III.

These were by no means the first invasion scares which the Cinque Ports had to face. In fact they were constant throughout mediaeval times, and the ports had always to be alert against attempted enemy landings. In this connection it is interesting to recall that a link connecting Hastings with the days of the Norman Conquest was saved from destruction during a demolition scheme in 1938. It was a fragment of an ancient stone wall, built to defend the town against the French, and it had been lost sight of for over 100 years, because it had been built into a house in such a way that it formed one of the walls. The relic now stands, an isolated fragment of masonry, about 20 feet long and six feet high. Another survival, this time a quaint one of totally different character, lives on at Winchelsea, which still appoints a "Keeper of the Look-Out" at a nominal salary. His alleged duty is to watch for the approach of the invading French fleet as in the days of old.

Hastings, Romney, Hythe, Dover, and Sandwich were the original ports, and to them were added in 1247 the 'antient towns' of Rye and Winchelsea. Hitherto informal members, they were admitted to the full brotherhood of the confederacy with its assembly of "Brotherhood and Guestling." When a Lord Warden is appointed, it is the normal custom for the ancient Court of Shepway to be summoned, and then the barons of the Cinque Ports—now the mayors of the towns—meet at Dover for his installation. But there was no pageantry or official installation when Sir Winston Churchill was appointed, because Dover Castle was then in use for very unceremonial purposes.

The traditional meeting place of the Court of Shepway was the Bredenstone, on the western heights of Dover, but in recent years the meetings have taken place in the hall of the old Priory of St. Martin, now incorporated in Dover College, and adjoining the Church of St. James, Warden Down, Dover. This was probably erected in the reign of Edward II, and was used as a court-hall for the Cinque Ports, in time becoming one of the principal court-halls, where the Lord Warden exercised a jurisdiction unique from the legal point of view, covering Admiralty, Chancery, and Lodemanage. In 1936, Lady Reading, widow of a former Lord Warden, unveiled a tablet commemorating this use for 600 years, up to the latter half of the XIXth Century.

Lord Reading had an obvious flair for the historic side of his office, a gift also enjoyed in full measure by Sir Winston Churchill, who was installed with all the traditional ceremony associated with it in the Summer of 1946, after victory had been won. On such an occasion the bells of Dover sound a welcome down the ways of "the Ports and Places of Landing", after which the company goes to the Church of St. Mary-in-the-Castle for a service known from old time as the "Hallowing of the Wardenship of the Cinque Ports in the name of God." Following this, the procession passes through decorated streets lined with troops and sightseers. Then, in the court of Dover College, already mentioned, the Court of Shepway is formed, consisting of the mayors of the Cinque Ports with certain other officials. The mayor chosen as Speaker requests the Lord Warden to take up his office and "faithfully to preserve the franchise, liberties, customs, and usages of the Ports." The LordWarden having acceded to this request, his flag is broken on the flagstaff of the College and a salute of 19 guns is immediately fired from the Castle, while the mayors and other barons

of the Cinque Ports (aldermen, and their equivalent, the jurats, and Members of Parliament for the Ports) do reverence by standing in their places and bowing.

Speaking on the occasion of the installation of Lord Willingdon in the Lord Wardenship—he was Sir Winston Churchill's immediate predecessor in office—Sir Austen Chamberlain said it was a great thing that from time to time in this democratic country we should be reminded of our history, brought face to face with the traditions of the past, made to think of our origin, and why we now enjoy the freedom which we possess, the privileges which are our birthright, and why we have preserved and enjoy the laws and liberties which have become too rare in many nations of the world. The Cinque Ports are unique in illustrating Sir Austen's theme. It would be difficult to exaggerate the part they have played in our national story; their chronicle is that of the history of England in miniature; and many of their surviving customs can be traced back to Norman, and even Saxon, times. The confederation goes back long before the Norman Conquest, because the towns were banded in alliance for military purposes in the days of the Saxons. So the history of the ports dates back almost incredibly far, and the oldest manuscripts extant speak of them as if they were even then ancient. As far as can be discovered, they originally came together as a federation to guard the Channel entrance. Edward the Confessor granted them their first charter, and that of Edward I preserves to them its liberties. History might have turned out differently if their ships had not gone northward with Harold to repel the Norsemen. This left the Channel open to the Conqueror's invading fleet. Their period of greatest power spanned, approximately, the XIIIth Century, and although ostensibly on the side of the Sovereign, the ships of the Cinque Ports were not above making extra profits, and they sometimes found it convenient to turn pirate, attacking English and foreign ships alike. It was Cinque Ports ships which took the main part in the famous and important naval victory of the battle of Sandwich (or battle of Dover) on St. Bartholomew's Day, 1217, when the French fleet of Eustace the Monk was destroyed. Eustace was a freebooter on land and sea, and a mercenary soldier, and it has to be recorded that, until shortly before the battle, ships of the Cinque Ports had been regular accomplices of his. That victory established one of the permanent factors in European history, English mastery of the narrow seas, which Philip of Spain, Napoleon, and Hitler tried in vain to shatter, and which was only temporarily shaken by the Dutch and French in the later XVIIth Century.

For a long period after the defeat of Eustace the Monk conditions were tempestuous and the men of succeeding generations in the Cinque Ports by no means abjured their lawless ways. Nevertheless, they certainly rendered important services to many Sovereigns. Domesday records numerous interesting items about these. Of Dover it records, "The burgesses provided 20 Ships for the Monarch once each year for 15 days and in each ship were 21 men. They rendered this service because the King had granted them Soc and Sac. When the messengers of the Monarch came to the port, they paid threepence in Winter, and twopence in Summer for the transportation of a horse; but the burgesses found a pilot and another assistant; and if more were required, they were furnished at the Royal expence." Among facts about the other ports were these, Sandwich :—"The Borough renders similar services to the Monarch as Dover", Romney :—"Robert of Romney has 50 burgesses in the Borough of Romney and the King has all services from them though they are exempt from all tolls and customs for their ships and naval services."

Their two great confederate charters were 1260 (Henry III) and 1278 (Edward I), and it was about this time that the seamen and ships of the ports may be regarded

as having become the real nucleus of a Royal Navy. The original five ports had to provide between them for the Royal service 57 ships, each manned by 21 men and a boy. They were bound to turn out when called upon and to serve two weeks without remuneration, after which they were in the King's pay. Such ships were not necessarily required for hostilities; on the contrary they were mainly employed on transport duties. In return for this service they enjoyed virtual self-government, and freedom from all county jurisdiction and harbour dues. Some of the principal privileges and immunities with which the Cinque Ports, ancient towns, and members were invested from or before the Conquest were Soc and Sac (Soc is a power planted in them to compel all persons who live within the confines of their liberties to plead in their Courts, and from hence, anciently, they were called Soccmanni, that is, suitors to that Court, where they were forced to plead, Sac is a privilege to take cognizance of causes, either criminal or civil, within their own Courts); Bloodwith and Fledwith (Bloodwith is a power to punish the effusion of blood, Fledwith is an authority to punish those who have committed any misdemeanour or outrage, and seeking to secure themselves by flight, are again seized upon, and offered up to deserved justice); Infangtheof and Outfangetheof (that is, a power to imprison, and upon just and legal evidence—which is the lanthorn of the law—to execute all those, though foreigners and aliens, which should commit any felony in places subject to their jurisdiction). The Court of Admiralty for the Cinque Ports shares with the Admiralty jurisdiction over persons and things found within the territory of the Cinque Ports. In the XVIIth Century the limits of its jurisdiction were declared to extend from Shore Beacon in Essex to Redcliff, near Seaford, Sussex; and with regard to salvage, all the sea between Seaford, Sussex, to a point five miles off Cape Grisnez on the coast of France, and the coast of Essex. The judge has a grant of the " place or office of judge official and commissary of the Court of Admiralty of the Cinque Ports, and their members and appurtenances, and to be assistant to my lieutenant of Dover Castle in all such affairs and business concerning the said Court of Admiralty wherein yourself and assistance shall be requisite and necessary." Of old the Court sat sometimes at Sandwich, sometimes at other ports; in more modern times the place of sitting was the aisle of St. James's Church, Dover. Nowadays the judge's only active duty is to officiate at the installation of a new Lord Warden.

The most important peace-time duty of the Cinque Ports confederacy was acting as controller of the great Autumn herring fair at Yarmouth. It lasted a month and was resorted to by fishermen from many countries, and in 1567 Nash wrote of the port, " The fishery is a great nursery of seamen, and brings more ships to Yarmouth than assembled at Troy to bring back Paris ", and of the fair a chronicler recorded, " Yarmouthe became ye resorte of a great store of seafaringe men, as also of great numbers of the fishermen of France, Flanders, and of Holland, Zealande, and of all the Lowe Countries from the Feast of St. Michael the Archangel, until the Feast of St. Martin, aboute the takinge, sellinge, and buyinge of herrings."

Originally the ships of the Cinque Ports landed and dried their herring catch on the desolate strand where Yarmouth subsequently arose, and had acquired its ownership by use and charter. Then a settlement of local fishermen grew into a little town and King John gave it a charter. Naturally much argument and disputation arose between the officials of the new town and the ancient Cinque Ports. The Yarmouth interests grew stronger as the importance of those of the confederacy waned, till in the Tudor period their delegates to the great fair, encountering nothing but insult and resistance to their claims to share the Yarmouth magisterial bench, ceased to press them after four centuries of this strange division of authority.

The leader of the federation was, as has been mentioned, the Lord Warden, who was also Constable of Dover Castle. The ports regularly sent representatives to the council of Brotherhood and Guestling, where all affairs were settled, such as the number of ships each port had to provide. The 'limbs', or members, enjoyed almost as much liberty as the major ports. To Hastings were attached the corporate members of Pevensey and Seaford, and the non-corporate members of Bulvarhythe, Petit Iham (Yham or Higham), Hydney, Bekesbourn, Northeye, and Grenche or Grange; To Romney, Lydd, and Old Romney, Dengemarsh, Orwaldstone, and Bromehill or Promehill; to Dover, Folkestone and Faversham, and Margate, St. John's, Goresend (now Birchington), Birchington Wood (now Woodchurch), St. Peter's, Kingsdown, and Ringwould; to Sandwich, Fordwich and Deal, and Walmer, Ramsgate, Reculver, Stonor (Estanor), Sarre (or Serre), and Brightlingsea (in Essex). To Rye was attached the corporate member of Tenderden, and to Hythe the non-corporate member of West Hythe.

The council of Brodhull, or Brotherhood, is second only in historical interest to the Witenagemot (the Great Council of the Anglo-Saxons, 'the Council of the Wise Men', composed of the leading nobility) itself, and deserves further description. The ancient courts of Shepway and Brotherhood and Guestling began in Saxon times, and the latter eventually superseded the former, whose chief duty now is the installation of the Lord Warden. These councils or courts took their name from the places where they met, Shepway being near Lympne; and Brodhull, from which the name Brotherhood evolved, near Dymchurch. The Brotherhood watched closely over the privileges of the ports, one which it defended with success against the Lord Marchers of Wales being that which entitled the barons of the Cinque Ports to carry the canopy at a Coronation. Although the barons still attend, unfortunately from the point of view of pageantry, the canopies have not been used for over a century. Very picturesque the barons look in black silk velvet coats lined with white silk, black silk velvet breeches, and white silk waistcoats, and over the coats long cloaks of flaming scarlet, with the arms of the Cinque Ports on the right shoulder.

The standing in which the Lord Warden is still held is shown by the fact that he is entitled to a salute of 19 guns within the limits of his jurisdiction, a number which is only exceeded by Royalty, though equalled by Admirals of the Fleet, Field-Marshals, Governors-General of Dominions, etc. He is also entitled to fly his own Standard, known as the Lord Warden's Banner, blue and yellow, the devices in the top right and bottom left hand quarters depicting his jurisdiction as Admiral of the Ports, and the castles in the other quarters his office of Constable of Dover Castle. The Banner is flown over the Lord Warden's residence, Walmer Castle, and at Dover Town Hall and Dover Castle when he visits that town. Sir Winston Churchill also has a small flag fixed to the bonnet of his car. The Lord Warden's perquisites include the exclusive rights to "flotsam, jetsam, and lagan" within the area of the Cinque Ports.

Pitt was, without question, one of the most picturesque holders of the office in modern times. He regarded the appointment with the greatest seriousness, interpreting its duties in terms resembling those of the warring ages of the past. After his resignation of the premiership in 1801, he lived much at Walmer, and with the threat of invasion by Napoleon becoming increasingly ominous, he partly revived the ancient institutions and prerogatives of his office. In 1803, he raised and drilled a volunteer force of 3,000 men, and there he spent his days in feverish anxiety, riding, reviewing, and manœuvring along the coast officially committed to his protective

care. So patriotically ardent was he in the discharge of his task that he would not leave Walmer, even for Westminster, if the wind blew from the east, so favouring a landing-force from the continent. The Duke of Wellington was the first Lord Warden to be unpaid (his predecessor, Lord Liverpool, got £3,000 a year), and he was the last to exercise one of the few remaining duties of importance, the control of pilotage between the North Foreland and Hastings. He presided regularly until his death over the Court of Lodemanage, and then within two years the pilot service passed to Trinity House.

Although most duties have fallen into abeyance, public opinion is never likely to agree to the abolition of the Lord Wardenship. A few, it is true, have objected that this unique association of maritime towns on our southern coasts, exercising a jurisdiction dating from the time of the Norman Conquest, and organized to some degree on French lines, is an anachronism out of place in modern times. But such is far from the general opinion, for not only do the Cinque Ports guard their rights and privileges jealously, but whenever there has been a suggestion put forward to abolish such venerable survivals as the Lord Wardenship, there has been an immediate outcry. When King Edward VII, for instance, proposed to turn Walmer Castle, the historic residence of the Lord Warden, into a national museum, public opinion decreed otherwise. It is still intermittently used as a home by holders of the office.

MILITARY MEDICINE FROM AESCULAPIUS TO THE AIR AND ATOM AGE

By Group Captain J. S. Carslaw, M.B., Ch.B., R.A.F. (Retd.)

"WAR'S a brain-spattering, windpipe-slitting art" Byron tells us in *Don Juan*, but it is an art which man has practised more assiduously than any other. This propensity towards inflicting mutilating injuries has created a demand for medical and surgical treatment which is utterly disproportionate to that arising from the avocations of peace. Thus the history of war medicine is as old as the healing art itself.

I have chosen to start my story in the XIIIth Century B.C. with a chief of Thessaly, Aesculapius by name. He fought in the Trojan Wars, and invented an instrument for removing arrow-heads from the depths of wounds. His skill in the healing art was sufficient to worry Pluto, who complained bitterly that it had prolonged life to such an extent that the population of Hell was threatening to diminish. Whereupon Zeus slew the offender with a thunderbolt, thus restoring the balance of population, reasserting the authority of Olympus in matters of life and death—and causing the prompt deification of Aesculapius.

Roman history, steeped in warfare and bloodshed, provides many interesting chapters in early military medicine and surgery, particularly from the pen of Dioscorides, a Greek army surgeon in the service of Nero in the Ist Century A.D. From such sources we know that experience of the surgery of wounds coloured the whole of surgical practice throughout these 13 centuries. Wounds were treated by washing with pure boiled water, or with wine, and dressed with clean cloths, and both Greek and Roman surgeons expected, and achieved, excellent results. But towards the end of the Roman Period the standard of surgical treatment deteriorated greatly, and the Dark Ages which followed were dark indeed for medicine and surgery. In fact, no real progress was made until the XIXth Century, when Lister established the theory of the antiseptic treatment of wounds.

Throughout the intervening years of ignorance, empiricism, and superstition, the belief in the supernatural origin of all disease was encouraged—and often brutally enforced—by priests of all religions who realized that their power and worldly fortune depended on universal ignorance and who, therefore, did all they could to foster superstition and prevent research. Nevertheless, in spite of the prejudices there was an occasional glimmer of truth—the sanitary laws of Moses, the teachings of Hippocrates and Galen, the principles of Arabic and Saracenic medicine—and then the darkness again descended until finally dispersed for ever by the great scientific discoveries of the past two centuries.

Admittedly, individual surgeons fought against the superstitions, but such brave men were branded as heterodox and unsound. For instance, in the XIIIth Century, a surgeon called Theodoric de Mondeville put up a gallant struggle for the clean treatment of wounds, but his views were overwhelmed by the teachings of Guy de Chauliac in the following century, who declared that the formation of pus was absolutely essential for the proper healing of wounds, thus supporting the pernicious fallacy which had been in existence since the end of the Roman Period. Guy was so highly esteemed that this remained the orthodox doctrine for another 500 years, and caused unnecessary human misery over all these centuries.

It is of interest to note that Guy classified five sets of surgeons. The first, to which he belonged, applied poultices to wounds. The second, like Theodoric, only applied wine to wounds. The third healed wounds with ointments. The fourth consisted chiefly of German army surgeons, who used charms, potions, oil, and wood ; while the last were old women and ignorant people who, in all cases, resorted to the saints. A recent comment on this classification says : " unhappily a comparison of the results of treatment by these five different methods was never undertaken. If it had been, Theodoric and his followers would almost certainly have headed the list, with the ' women and silly folk ' a close second."

The later XVth Century is of great interest to all military historians on account of the many developments which took place in arms, tactics, and organization due to the invention of gunpowder. To the medical historian, this period is of significance because gunshot wounds now, for the first time, became the normal type of casualty. This period, too, is of especial interest to the medical historian on account of the greatly improved status of the military surgeon.

To understand the military medicine and surgery of the XVIth Century it must be recalled that during the Dark Ages surgery had been torn from medicine and had become a separate branch of knowledge, or lack of knowledge. While medicine remained in the hands of men of education, surgery had fallen to the care of charlatans, mountebanks, and the rag-tag of humanity. This disastrous state of affairs was due largely to the prejudice of the mediaeval church against the shedding of blood. However, fortunately there were honest men, though few, who were conscientious practitioners of their craft, and these had all learned their surgery in that great school of experience, war, which school had been recommended by no less an authority than Hippocrates. But then, as always, the quacks and charlatans were the spoilt children of the British legislature, and towards the end of the XVIth Century they are aptly described by the great military surgeon Gale as :—

> " The rabble of rude empiricks (and drosse of the earth, which when they cannot otherwise live, chop straight waies into the art of chirurgerie) be no chirurgions, but manquillers, murtherers, and robbers of the people ; such are some hosiers, tailours, fletchers, minstrells, souters, horseleeches, juglers, witches, sorcerers, bawdes, and a rabble of that sect, which would by lawes be driven from so divine an art, the exercise of which, for want of knowledge bringeth sometime losse of member, sometime of life, and sometime both of limme and life."

Thus, while the honest surgeons banded together in the Barber Surgeons' Company, so as to raise the standard of surgery, outside the craft the quacks flourished. Many of them found their way into the Army, and their ignorance often proved fatal to the unfortunate wounded who came under their care.

Fortunately for the wounded, the XVIth Century brought a great advance in the treatment of gunshot wounds. The famous French army surgeon Paré had refused to accept the views of his predecessors and always strove to reduce the amount of unnecessary pain that the wounded soldier had to endure. He it was who ended the days of the orthodox scalding oil treatment of gunshot wounds, by reason of having to use bland dressings on an occasion when his supply of oil failed. To his delight, those so treated were in much better shape than those cauterized with scalding oil. He said " I thought this much, that neither I nor any other should ever cauterize any wounded with gunshot ". The modern treatment of gunshot wounds was born. Such was his fame that his presence was considered to be as

valuable as a reinforcement of several thousand men. When he appeared in a camp or garrison, it was not uncommon for the soldiers to turn out and cheer him on his arrival, an experience not normally granted to medical officers.

It is of interest to note the method of recruitment of surgeons to the English Army of those days. In the reign of Henry VIII there are a number of references to the engagement of surgeons, but whether voluntarily or under compulsion is uncertain. By the time of Queen Elizabeth I there is no doubt whatever as to the method of supply; surgeons were pressed or conscripted just like any other non-commissioned officer or man. There was, in the XVIth Century, quite as strict a conscription of part of the medical profession as was in force during the two great wars in the first half of the XXth Century.

Further, the salary, even with the methods of compulsion then in vogue, of the junior surgeons (they ranked as non-commissioned officers along with the drummer, fifer, and chaplain, and received 1s. a day) was insufficient to obtain the numbers of surgeons required. In order to obtain them, it became necessary to supplement their money from some other source. The source chosen was the pay of the unfortunate private soldier. For instance, we learn from one writer of those days :—

> " That every souldier at the paye day, do give unto the surgeon 2d. ' as in tymes past hath beene accustomed ', to the augmentation of his wages, in consideration whereof, the surgeon ought readilie to employ his industrie uppon the soare and wounded souldiers not intermedlinge with any cures to them noysome."

In looking for a means of attracting doctors to the military medical services in the middle of the XXth Century, it would seem that here are possibilities which should not be overlooked by the Treasury.

By 1660, we reach another milestone with the formation of the first permanent standing army in England. In the early days its medical service was entirely regimental, medical officers wearing the uniform of their particular regiment.

We know too that by this time ships of war, at least, had surgeons; the majority of ships had none. Smollett, who served for a time as a surgeon's mate, describes the hospital of a man-of-war :

> " Here I saw about fifty miserable distempered wretches, suspended in rows, so huddled one upon another, that not more than fourteen inches were allotted to each with his bed and bedding; and deprived of the light of day as well as of fresh air; and breathing nothing but a noisome atmosphere . . . devoured with vermin . . . The doctor, when visiting the stick, thrust his wig in his pocket, and stript himself to his waistcoat; then creeping on all fours under their hammocks, and forcing up his bare pate between to keep them asunder with one shoulder until he had done his duty."

In the XVIIIth Century, service medicine advanced rapidly in stature, and in the Army we find conspicuous names like those of Pringle, Guthrie, and Hunter, and in the Royal Navy those of Lind, Blane, and Trotter. Despite its reputation as the Augustan age, life was harsh in the XVIIIth Century. Certainly the outstanding achievements of men like these six did much to improve the lot of the sailors and soldiers then, and later.

Sir John Pringle, who has been called the father of Military Medicine, produced in 1752 his *Observations on the Diseases of the Army* which lays down the principles of military sanitation as we practise them to-day. He is further known

to fame as the originator of the Red Cross principle, for at the Battle of Dettingen in 1743, he suggested to the Earl of Stair that the military hospitals of both the French and the English sides should be regarded as neutral and immune from attack. This idea remained loosely in force until it was placed on an absolute basis through the work of the Swiss banker and philanthropist, Henri Dunant, which culminated in the Geneva Convention of 1864.

Napoleon, who is frequently accused of having cared but little for his sick and wounded, took exceptional trouble to organize an efficient medical service. One of his most famous surgeons, Dominique Jean Baron Larrey, invented the "flying ambulance," which consisted of three surgeons and one assistant, who were mounted on vigorous horses and carried first-aid dressings across the battlefield. Contrary to cherished tradition, Napoleon's defeat in Russia was not due to cold and starvation. His army was well clothed, superbly equipped, and perfectly fed, in accordance with the Emperor's dictum: "The army is like a serpent—it marches on its belly." The real enemy which mowed down and decimated his men was an epidemic of typhus.

It was during the Napoleonic wars that an effective medical service made its appearance in the British Army under the Duke of Wellington in the Spanish Peninsula. Imperfect though it may seem by modern standards, it succeeded in keeping down the disease death-rate to a little more than half that of the French Army. Unfortunately, this lesson was quickly forgotten. In the Crimean War, the British troops went into the campaign so badly equipped that the disease death-rate rose to 23 per cent. per year, being more than four times as great as the battle death-rate. Medical arrangements at the seat of the war, out of date and incompetent, had completely broken down through the petty bunglings of minor officials, the lamentable ignorance of Cabinet Ministers, and the fatal exactitudes of red tape.

When Florence Nightingale arrived at Scutari, a suburb of Constantinople, there greeted her incredulous eyes a huge barrack-house with endless corridors, inhabited by want, neglect, confusion, and misery. Large sewers underlay the building, and foul cesspools wafted their poison into the upper rooms. Multitudes of vermin swarmed everywhere. There was no ventilation, and the stench was indescribable. It was in this sinister nightmare of filth and horror that Florence Nightingale organized a highly efficient hospital and sanitary system, which made the after-treatment of surgical operations possible to contemplate. Thus military nursing laid the foundations of modern nursing, which, until then, had been an occupation followed only by prostitutes, or, in some countries, nuns.

By the end of the XIXth Century, all branches of medicine were making rapid advances. By now the Army, as well as the Royal Navy, had a highly organized medical service, which not only brought to the fighting man the most skilled attention possible, but, in fact, made great contributions of international importance to research. At the birth of the XXth Century we find Britain at war in South Africa, and her armies bogged down by the Boers and typhoid fever. This disease alone brought nearly 30 per cent. of the force to hospital and caused the death of more men than were killed by the enemy. Fortunately, by the closing stages of the Boer War, we entered the era of immunization against disease with the introduction of anti-typhoid vaccine by Sir Almroth Wright of the Army Medical School, Netley. This advance was to prove of inestimable benefit to mankind, and, from a military standpoint, has alone made it possible, in two world wars, to maintain enormous and concentrated armies in the field without a disastrous epidemic.

Thus we come to the Air Age, and the 1914–18 War, and we reach the age in which we ourselves are living and making history every day. It is an age in which the aeroplane has introduced new forms of warfare, and has posed its own peculiar occupational hazards. By 1917, we find a recommendation for an independent medical service for the R.F.C. and R.N.A.S., the reasons being " that aviation presents new physiological and pathological problems which require special study and which can only be dealt with satisfactorily by a specially trained body of men." The first purely R.F.C. medical unit—a hospital at Hampstead for R.F.C. and R.N.A.S. patients only, where the medical staff was mixed naval and army—was formed on 11th October, 1917. There were, therefore, the elements of the Medical Branch of the Royal Air Force already in existence when the R.A.F. was formed on 1st April, 1918.

The aeroplane has, of course, humanitarian as well as destructive functions, and the transport of war casualties by air not only has outstanding medical and surgical advantages, but has great morale value to the fighting man and helps to keep the ground lines of communication clear for essential military movements. The possibilities of air evacuation of patients were first exploited before the Wright brothers' epoch-making flight, as history tells us that 160 patients were successfully evacuated by balloon from Paris during the siege in 1870. Isolated instances of evacuation of individual patients by air occurred in French, British, and American air forces during the 1914–18 War, but the first records of organized air evacuation by the R.A.F. appear during the war against the ' Mad Mullah ' in Somaliland in 1919. From then until the outbreak of war in 1939 the R.A.F. transported some 2,900 casualties by air, almost entirely in Iraq, Palestine, and India.

Between 1939 and VJ-Day the R.A.F. had carried more than 400,000 sick and wounded in all war theatres, and in so doing had undertaken some 30,000 sorties without mishap. In the later stages of the European operations, 90 per cent. of casualties were transported by air. On occasions air transport was the only practicable method of evacuation, especially in Burma, where the only alternatives would have been to carry patients through the jungle or leave them where they were if the advance was to continue. Air transport meant that such casualties were moved from forward areas to base hospitals in a matter of hours, for a journey which might have taken weeks to accomplish, had it even been possible. More recently we have seen that soldiers wounded in Korea and other Far Eastern theatres can be in hospital in the U.K. within a few days.

With the close of the 1939–45 War we have now entered the Atom Age—the age of ABC weapons of mass destruction and staggering numbers of casualties, posing new and greater problems for the medical services, both military and civilian, in the field of radiation, bacteriology, and chemistry. The Air Age, too, has new problems, and so long as military aircraft are manned, the need will exist for research by the medical staff of the R.A.F. to solve the physiological problems arising from flying at stratospheric altitudes and supersonic speeds, and thus to ensure the safety and efficiency of flying personnel.

CIVIL AVIATION — PROGRESS AND PROBLEMS

By Major-General D. A. L. Wade, C.B., O.B.E., M.C., B.A., A.M.I.E.E.

AVIATION as a means of transport has, during the last decade, become so commonplace that one can hardly turn over the pages of a newspaper without finding some reference to it either in the news or in the advertisements. It is, therefore, surprising to find that the literature on the subject is scanty. Outside the specialized Press devoted to the technical aspects of aviation, the reader will probably find less than a dozen works dealing with the subject in any library. And yet it is a matter of considerable, one might even say vital, interest to the Nation. For as in the past the prosperity of these islands has depended on our ability to transport our own and other peoples' goods and passengers by sea, so in the future our ability to perform those same functions by air—as well as by sea—will be a major factor in deciding our destiny.

The object of this article is to outline briefly the history and development of civil aviation and to touch on some of the problems confronting those engaged in it.[1]

It is just 51 years since the Wright brothers performed the first brief flight in a heavier-than-air machine. The date—17th December, 1903—has come to be recognized as the birthday of aviation. Before that date men had flown in balloons and dirigibles. A few had experimented with heavier-than-air machines. Leonardo da Vinci in the XVth Century was probably the first man to realize that the natural resistance of air to the movements of objects passing through it might provide the basis for a flying machine. He constructed a model with flapping wings and when this failed to fly he turned to a primitive form of helicopter with a rotor made of feathers.

Some 300 years later an Englishman, Sir George Cayley (1773–1857), constructed a series of model helicopters, one of which reputedly reached a height of 90 feet, and then turned his attention to model gliders. Cayley seems to have been the first man to deduce the fundamental principles of the science of aerodynamics. He carefully recorded the results of his experiments. They were to prove of great value to those who followed in his footsteps.

The early pioneers of the heavier-than-air machine were handicapped by the lack of a sufficiently powerful, yet light-weight means of propelling their gliders through the air. The majority of would-be fliers, however, were not interested in gliders, since in their opinion the only practical solution of the problem of man's conquest of the air lay in lighter-than-air machines. It was left to the Americans, Wilbur and Orville Wright, both of them capable mechanical engineers, to design a light-weight petrol engine capable of driving their glider through the air at sufficient speed to lift man and machine. Their triumph was only achieved after several years of painstaking experiments and research during which they built three gliders (in the last of which they carried out over 1,000 flights) and which included the use of a wind tunnel.

The accomplishments of the Wrights created a tremendous impetus to inventors in other countries—notably England and France. The history of aviation in the period 1903–1914 is associated with the names of many distinguished pioneers, of whom Blériot, Brabazon, Cody, Farman, Rolls, Sopwith, and Voisin are amongst the

[1] Up to March, 1955.

most famous. All made their contributions to the science of aviation, but it was the 1914–18 War which firmly established aviation on its wings. When war was declared France was in the forefront of aviation, mainly owing to the progress made in aero-engine design by French engineers. In a short time the resources of Rolls-Royce and Napier were turned over to aero-engine design and manufacture. From that day until this Britain has, generally speaking, maintained a supremacy in aero-engine design over all her competitors; and that supremacy was never more marked than it is today.

When the war ended in 1918 we had developed twin-engine aircraft capable of carrying heavy loads of bombs over considerable ranges. These machines were readily adaptable to the carriage of passengers and mail. It was in one of these, a Vickers Vimy, that Alcock and Brown completed the first crossing of the Atlantic from Newfoundland to Ireland in June, 1919. Within a few months private companies had been formed to operate regular services for passengers and mail between London and Paris, Brussels, and Amsterdam. By 1924, there were four such companies operating, Stratton Instone, Daimler Hire, Handley Page, and the British Marine Air Navigation Company. These four then amalgamated their interests to form Imperial Airways. Similar progress was recorded in France, Holland, the United States, and later in Germany.

The general pattern of civil aviation between the two world wars was marked by three major developments.

Firstly, the long-range four-engine flying-boat was produced to cover the long oversea flights involved in inter-continental air travel. Probably the most famous of these were the Boeing Clippers with which Pan-American Airways spanned the North Atlantic and Pacific; the Dornier flying-boats which the *Lufthansa* employed on their South Atlantic routes to South America; and the Short "Imperial" class flying-boats of Imperial Airways. Although no very long oversea flights were involved, these last machines were to be found on the Empire air routes to South Africa, India, and the Far East, where they alighted and took off from river, lake, and harbour like some gigantic water fowl.

Today the large-flying boat has, with minor exceptions, fallen into disuse and there are many who lament her passing. Probably no other machines could give the passenger such a feeling of comfort, space, and security as did these graceful and ubiquitous craft.

Secondly, the development of aluminium alloys enabled the aircraft designer to cast aside linen and other fabrics as a covering for fuselage and wings and turn to the all-metal type of construction with its attendant advantages of increased strength and durability, which—coupled with advances in engine design—in turn led to increased speed, size, and payload.

Thirdly, there was the virtual disappearance of the biplane and its replacement by the monoplane. This fundamental change in design resulted in higher speeds without sacrifice of strength, stability, or payload.

By 1939, virtually all the important capital cities of the world were connected by air services operated by a dozen or so international airlines. Flying was mainly carried out during hours of daylight since navigation was largely a matter of dead reckoning. The compass was the main navigational instrument, supplemented by visual observation of stars and landmarks when visibility permitted. Wireless telegraphy was the normal means of communication, and radio direction finding

equipment provided a further means of position checking. In short, the air navigator employed the well-tried methods of his marine counterpart. Unlike the latter, however, the airman is unable to slow down and proceed with caution when conditions of poor visibility are encountered. He must proceed at high speed and reach an airport before his limited fuel runs out. For these reasons air travel over long routes was, up to the last war, usually confined to the hours of daylight and flights were not infrequently delayed or cancelled due to weather conditions.

From the passenger's point of view these flights entailed the disadvantage of an inordinately early rise from his or her bed in order to be airborne at first light. Typical of the long distance flights of those days was one which the writer experienced in 1938 between London and Karachi by Imperial flying-boat. Including the overnight journey from London to Southampton by train, the total journey time occupied four brief nights on the ground at Southampton, Rome, Cairo, and Basra and four full days of flying. In addition to the night stops, there were nine refuelling stops. Today B.O.A.C. service is scheduled to perform the same journey in under 24 hours with one stop only en route.

So far, mention has only been made of the aeroplane. It is perhaps now liable to be forgotten that up to the early 1930's the airship was a serious competitor to the aeroplane as a means of commercial transport. It was certainly in the field earlier. Even before 1914 the Zeppelin Company was operating commercial flights for passengers in Germany. After the 1914–18 War, as soon as the Treaty of Versailles was signed and the Germans were permitted to take up flying again, they returned to airship construction under the leadership of Count Eckener. The Graf Zeppelin, launched in 1928, had an active life of nine years, during which she carried over 13,000 passengers and made 144 ocean crossings, mainly from Europe to South America. In 1930, Britain launched the R100 and R101. The latter crashed on her maiden flight to India on the night of October 6th, 1930, and the R100 was immediately scrapped. About the same period similar misfortunes with large rigid airships were encountered in France and the United States. Notwithstanding, the Germans persisted and in 1936 launched the Hindenburg. It was not until this ship was destroyed by fire whilst landing at Lakehurst, New Jersey, in 1937 that Germany finally abandoned the airship.

The 1939–45 War naturally gave a tremendous impetus to aviation in general. Looking back over this period it is probably true to say that there emerged two major developments which have fundamentally altered the pattern of civil aviation. These are the jet engine and radio aids to navigation. In making this statement one in no way wishes to minimize the contributions made to post-war civil aviation by the United States. They alone, despite their colossal war effort, were able to spare the resources to carry on without interruption throughout the war years the development of machines suitable for airline operations. Consequently, when civil aviation was resumed after the war, the airlines of the world were faced with little option but to purchase American aircraft. It is only in the last two years or so that British aircraft manufacturers have emerged as serious competitors to their American rivals. Even today B.E.A.'s fleet still numbers a few D.C.3's—the famous Dakota; whilst B.O.A.C.'s fleet is nearly 50 per cent. American and they are now purchasing further aircraft from the Douglas Corporation. It is, however, to the credit of British industry that throughout the post-war period British aero-engines have held their own against all comers, and despite the handicap of the war years our aircraft designers have now caught up with the Americans. Proof of this lies in the Vickers

Viscount turbo-propeller-engined airliner which, having swept the board on the European short and medium haul routes, has now been ordered in large numbers by Capitol Airlines, one of the major domestic airlines in the U.S.A.

The jet engine in its present state of development has been applied to civil aircraft in two forms. The turbo-jet or straight jet, as used in the Comet, derives its propulsive power from the continuous combustion of a mixture of air and paraffin, the exhaust gases from which emerge in the form of a high velocity jet stream. The propulsive action may be likened to that of a continuously burning rocket. It has an uneconomically high fuel consumption except when operating at high altitudes and high speeds—the Comet normally cruises at about 40,000 feet and 450–500 m.p.h. It is singularly free from the vibrations associated with the piston engine-propeller power unit.

The turbo-propeller engine is basically a turbo-jet engine adapted to drive a propeller. The exhaust gases, instead of being directed into the atmosphere, are channelled to drive a turbine which in turn drives a propeller. The turbo-prop is comparatively quiet and free from vibration. Its fuel consumption is comparable to that of the piston engine and it can operate economically over a wide range of altitudes. It is capable of speeds in excess of piston engine speeds, but not so high as those of the straight jet. It is undoubtedly an engine with an immense future. Strange to say, our American cousins have only recently realized this. It is the power unit for the Bristol Britannia as well as the Viscount.

It would appear that both the straight jet and the turbo-prop will find their places in civil aviation in the near future. The turbo-prop is well suited to the short and medium haul routes where large increases in speed show a relatively small saving in overall travel time owing to the large proportion of non-flying time involved, e.g. between cities and their airports. It may also find its place in long haul routes for tourist class passengers and freight, where high speed is not of primary importance. The straight jet on the other hand is likely to be used for first class passenger services on long haul routes, where high increases in speed represent a considerable saving in overall travel time.

One may well ask, " Why all this need for such high speeds ?" The writer suggests that there are two answers to this question, " Because passengers want it, and because the airlines want it." The passengers want it because long non-stop flights, such as London to New York, are tedious and tiring. The human body is unused to sitting in a chair—however comfortable—for (say) 12 hours on end, and being subject to atmospheric pressures equivalent to an altitude of (say) 8,000 feet for such periods. The sooner the journey is over the better the average passenger is pleased. The airlines want it because—other factors being equal—the faster the speed the greater the number of journeys an airliner can perform in a given time, and hence more revenue can be earned.

The rapid strides achieved during and since the last war in the science of electronics have led to an almost embarrassingly large number of radio aids to navigation being placed at the disposal of the operators of airlines and airports. Considerations of weight, cost, and the need for uniformity in standards and procedures have reduced the field to certain types of equipment which may briefly be classified under three headings :

(*a*) Airport aids.
(*b*) *En route* aids.
(*c*) Long range aids.

At the same time the morse key has vanished from the cockpit and been replaced by the microphone, enabling the captain of an airliner to be in constant telephonic communication with the ground from take-off to touch-down. Space does not permit of other than a very brief description of some of the principal aids now in general use.

(*a*) *Airport Aids*

The object of airport aids is to enable a pilot to follow the correct path of descent when atmospheric conditions are such that he cannot see the airport on which he wishes to land. One system in common use is I.L.S. (Instrument Landing System). This enables the pilot when approaching his destination to follow an imaginary path—known as the glide path—which will bring him down near the end of the runway. Two V.H.F. (very high frequency) radio transmitters situated at the end of the runway trace this path. One transmitter indicates to the pilot whether he is above or below the path, the other indicates whether he is to right or left of it. All the pilot has to do is to watch two needles mounted on a single dial and manœuvre his aircraft so that the needles are kept at right angles to each other, the one horizontally and the other vertically. The former indicates any deviation above or below the glide path, the latter indicates deviations to right or left. This system normally operates in conjunction with two or three vertically directed radio beacons situated at standard distances in prolongation of the line of the runway. As the aircraft passes over these beacons, visual and aural signals indicate to the pilot that he is passing over the outer, middle, or inner " marker ".

Another system is G.C.A. (Ground Controlled Approach). Three radar stations are situated near the end of the runway. These stations enable a radar controller to watch on a fluorescent screen (somewhat similar to the screen of a television set) the movement of an incoming aircraft which appears as a bright spot of light. The first radar with its associated screen picks up the aircraft at a distance of about 30 miles, and the pilot is then directed by radio-telephony on to the correct path of approach. The other two radars then take over the aircraft. On the screen of one the operator can tell whether the aircraft is above or below the glide path, on the screen of the other the operator can tell whether the aircraft is to the right or left of the glide path. Either screen indicates the distance of the aircraft from the end of the runway. The information from these two screens is fed to the radar controller who talks the pilot down over the radio-telephone. His instructions are in the following form :—

" You are 100 feet above glide path. Heading 190 degrees."

" You are 20 feet above glide path. Heading 188 degrees."

" Five miles to touch-down."

" You are on glide path. Heading 189 degrees."

And so on until the pilot breaks through the cloud and sees the end of the runway at (say) 400 yards and 200 feet below him.

(*b*) *En route aids*

In countries where a high density of aircraft traffic is in continuous operation, e.g. U.K. and U.S.A., civil aircraft are directed to follow definite airways between airports. To facilitate the traffic on these an elaborate system of air traffic control is operated on the ground from which instructions and information are fed to aircraft by radio-telephony. In turn, the captain of an aircraft is required to notify his position to ' control ' from time to time. To enable him to do so and to facilitate his

navigation, several types of radio aids are employed. These may conveniently be described as the radio equivalent of lighthouses. Vertical radio beacons similar to those already referred to in connection with I.L.S. are used to mark important points on air routes. Another type of radio beacon operates like the rotating beacon of a lighthouse; but it is even simpler from the pilot's point of view, since the bearing of the aircraft from the beacon is automatically and continuously shown on a dial (like a compass dial) in his cockpit. These beacons situated on either side of an airway at intervals of about 200 miles enable a pilot quickly to locate his position by means of cross-bearings from a pair of them. The system is now in universal use in U.S.A. It is known as V.O.R. (V.H.F. Ommi Range). Similarly a single V.O.R. may be situated on or near an important airport to give the pilot his correct 'heading' towards it.

(*c*) *Long Range Aids*

In principle these are similar to *en route* aids; technically they differ from them. Being required to operate over long ranges—for example to guide an aircraft in mid-Atlantic—they entail powerful radio transmitters operating in the medium and high frequency bands, located in pairs or threes and spaced some hundreds of miles apart. For example, two pairs of stations located at intervals on the eastern seaboard of the U.S.A. between Maine and North Carolina would enable a pilot half-way across the Atlantic to New York to check his position from time to time with sufficient accuracy until, when within 100 miles or so of his destination, he comes within range of the more accurate *en route* aids. There are at least three different systems in use today, but no one of them has been accepted internationally, with the result that a diversity of receiving equipment is to be found in the various international airlines. The two commonest systems are Decca (British) and Loran (American). Both are available to guide shipping as well as aircraft.

In the space of this article it is not possible to refer to the numerous other types of electronic navigational instruments available to aircraft. Many of them are unlikely to come into general use, since the pilot of an airliner is already confronted with an almost embarrassing array of switches, knobs, dials, and meters. Suffice it to mention two systems of navigational aids which are now past the initial experimental stage and gradually finding their place in the cockpits of civil aircraft. The auto-pilot operating off the I.L.S. signals enables an aircraft to land itself whilst the pilot sits idle but watchful in his seat. Airborne radar mounted in the nose of an aircraft enables the pilot to detect dangerous storms ahead of him by means of a screen mounted in the cockpit.

Aviation is now passing through a phase where advances in methods and design are facing the operators of airlines with many and formidable problems. The Comet I has given us experience of cruising speeds of close on 500 miles per hour at heights of 40,000 feet. Cruising heights of 50,000 or 60,000 feet are not unlikely in the future. Meteorological conditions at these altitudes have yet to be fully explored, but it is known that in certain areas of the world jet streams are fairly common. These are streams of air often 100 or more miles wide and travelling at velocities of several hundred miles per hour. They may be used to accelerate flight if encountered in the right direction. On the other hand, if encountered in the wrong direction they may hinder flight to the point of danger.

With jet engines another problem arises, that of high landing speeds and how to compete with them without extending the already considerable length of runways.

Propeller-driven aircraft can reverse the pitch of their propellers on landing so as to exert a powerful backward thrust to supplement wheel brakes. They can thus pull up in a few hundred yards. With jets this is not yet possible. So far no one has succeeded in designing a practicable reversible jet. No doubt the problem will be solved in due course.

Let us turn now to the economics of airline operations. The writer believes it to be the case that all international airlines are subsidized in one form or another. It may be by direct subsidy in the form of deficiency payment, or by indirect payments concealed in high mail rates, or by a Government bearing a proportion of development charges for new types of aircraft. In some countries domestic airlines are also subsidized. It is presumably the aim of most countries to make civil aviation self-supporting, both as regards air routes and airports. There is some way to go before this aim is achieved, if indeed it is ever to be achieved.

The bulk of airline revenue is derived from passengers; as yet mail and freight form a small proportion of total revenue—less than 20 per cent. in the case of B.O.A.C. and B.E.A. in 1953–54. On the long haul routes (over 1,000 miles), in spite of relatively high fares, profits are being earned, but in the medium and short haul routes airlines are struggling to reduce losses. This tendency is reflected in the accounts of our nationalized air corporations. B.O.A.C. has shown a profit over the last three years, B.E.A. is still 'in the red'. The reason why the medium and short haul routes are unprofitable is due to the high incidence of landings with their accompanying airport dues, and to the high proportion of time spent on the ground and in climbing to cruising height.

The further introduction of tourist class flights with their high density seating and reduced amenities (e.g. simple meals and no cocktail bars), combined with a modest increase in speed, may offer a partial solution for the medium haul routes (up to 500 miles), but neither tourist accommodation nor higher speeds will offer a solution on the short haul routes (up to 250 miles). To compete with surface transport over these short distances, air fares must become comparable to surface fares by rail, road, and water, and offer a substantial saving in overall journey time. There is, for example, no great advantage in flying from London to Manchester in three-quarters of an hour if one has to spend an hour at each end travelling from and to the centres of those cities by airport bus. The answer to this problem will probably be found in the helicopter, but not in its present form. It is as yet too costly and too small. We have to look into the future for some form of air bus which will take us from Waterloo to the Place de la Concorde in an hour or less. Such a machine will have rotors or possibly jet engines (cf. the Rolls-Royce flying bedstead) to enable it to rise and descend in the vertical plane, and small wings with propellers or jets for flight in the horizontal plane. The landing places, or heliports, will have to be well above ground level in order to minimize the noise of operations in the centres of cities.

Another factor which may affect the economics of airlines increasingly in the future is the carriage of freight. At present air freight is mainly confined to livestock, precious and fragile goods (e.g. drugs, precious stones, electronic valves), and special cargoes such as ships' propeller shafts and other urgently needed pieces of machinery. But there is already a tendency to cover more normal types of freight, e.g. certain classes of textiles, and this may well extend.

The above are just a few examples of the problems. Most of them are being studied continuously by the various airlines and Governments concerned on the international level through the International Air Transport Association and the International Civil Aviation Organization (I.C.A.O.). The latter is the specialized agency of the United Nations charged with the task of furthering and regulating civil aviation. It was established by a resolution of the International Air Conference at Chicago in 1944. It embraces 63 member nations and operates through a standing council on which 21 States have seats. The Council and Secretariat are located in Montreal; there are also eight regional offices in various parts of the world. The main tasks of the I.C.A.O. are the standardization of such subjects as the qualifications of air crews, rules of the air, air traffic control, airfield standards and systems, navigational aids, telecommunications, meteorological systems, and aero charts. Being a specialized agency, its work is little known to the general public, but by furthering the cause of international air travel it is performing a task the importance of which cannot be overstated.

Today the old-fashioned diplomacy has largely been supplanted by personal meetings between statesmen; men and women in all walks of life and of different nationalities are daily brought in contact with one another; and mails traverse the oceans in a matter of hours instead of weeks. Such speedy communications cannot fail to bring about a better understanding between nations, and thereby contribute towards peace. And all this has come to pass through civil aviation, a mere stripling of 35 years.

FLIGHT REFUELLING AND THE V-BOMBERS

By Captain Norman Macmillan, M.C., A.F.C., A.F.R.Ae.S.

In my article on flight refuelling in the February issue of the Journal I was unable to state that this means of extending range had been adopted by the Royal Air Force otherwise than experimentally, because no official information had been released up to the date of publication of the Journal. This security blackout has since been removed by the Under-Secretary of State for Air. Introducing the Air Estimates for 1955–56 in the House of Commons on 10th March, 1955, Mr. George Ward, *inter alia*, said :—

> " The essence of the new bomber force, and indeed of strategic air power, lies in its flexibility both to strike quickly at targets far away and, with the help of Transport Command, to move from base to base at short notice. The Canberras are already making many hundreds of flights a year to overseas bases in all parts of the world. This mobility and flexibility will be developed by the V-bombers and further improved by the use of flight refuelling. It will be possible to refuel a large proportion of our V-bombers in flight. Sets of equipment are being designed which can quickly convert a bomber into a tanker. Assisted take-off from shorter runways both at home and abroad will also be possible. Some of the aircraft will be interchangeable between the bomber and the photographic reconnaissance roles."

Now that Mr. Ward has told the world that " a large proportion " of the V-bombers is to be refuellable in flight, it becomes possible to discuss in very broad terms what this means.

First, it is desirable to understand that in the air parlance of today the Canberra is a light bomber, the V-bomber ranks as a medium bomber, and the heavy bomber, the aircraft weighing a gross total of about 350,000 lb., is sparingly represented by such types as the B-36 and the B-52 of the United States Air Force Strategic Air Command. The Soviet Air Force TU-37 is believed to fall into the medium-heavy class, and perhaps weighs 100,000 lb. less than the B-52.

It is mathematically demonstrable (and borne out in practice) that range increase does not rise in direct proportion to increase in the gross weight of aircraft. If it did, all the principal air forces of the world would be currently compelled to build the largest possible aircraft in order to maintain their defensive status, and the United Kingdom, with its programme of medium bombers, would be defended by an air force inadequately equipped.

The United States developed her current heavy bomber as an intercontinental strategic aircraft to be based on the North American Continent. This class of bomber (and the TU-37) has the disadvantages of slower rate of production, very high first and operating costs, and marked time lag between take-off from base and arrival over an intercontinental target, with attendant intelligence difficulties. The sole advantage—range—is discounted when it is realized that flight refuelling gives a medium class bomber approximately the same range as the built-in range of a heavy bomber with equal bomb load.

The British V-bomber concept is that of a most efficient medium bomber, whose height, speed, and load configurations must exceed those of the American B-45, and whose range with flight refuelling must approach that of the B-52 without flight refuelling, which places it in the strategic intercontinental category. Bearing these

things in mind, one would venture to say that all concerned with the British V-bomber decision—from conception to completion—deserve the appreciation of the Nation for the appearance of a strategic aircraft of great efficiency at a saving in expenditure relative to the United States or Russian conceptions of strategic air defence.

Mr. Ward's reference to sets of equipment to convert a bomber into a tanker can only refer to what is called the ' pack unit ' which fits into the existing bomb bay of a bomber. Designed by Flight Refuelling Ltd., it combines a hose drum unit (from which the drogue is trailed) and the extra fuel supply tanks into a single component.

This component can be transported on a trolley similar to a bomb trolley. When hoisted into the bomb bay, feed arms plug into the bomber's electrical supply to energize the hose reel and pumping mechanisms, and fuel pipes connect to the existing internal fuel system at convenient points in order to meet any further fuel demand from the bomber after the pack unit tanks have been emptied. Both the mounting and connecting points are incorporated in the standard bomber installation to provide quick interchangeability between bomber, photo-reconnaissance, and tanker roles. When an aircraft is no longer required for tanker duty, the pack unit can be removed with ease.

Apart from the obvious economy of the method selected by the Royal Air Force for the flight refuelling of its strategic bombers, another aspect deserves attention. The U.S.A.F. Strategic Air Command has hitherto concentrated its resources on the creation of Stratofreighter transport-tankers. Because these piston-engined aircraft have a speed and ceiling of about 275 m.p.h. and 25,000 feet, the S.A.C. jet bombers are compelled to descend and reduce speed for airborne refuelling, both of which are operationally disadvantageous in time and fuel consumption. There is no doubt that maximum efficiency in flight refuelling is obtained when tanker and receiver are of the same class of aircraft. The refuelling operations of the British V-bombers should therefore be very considerably more efficient than those of the American B-45 bombers. This may produce an American switch-over to jet tankers, which in turn must involve a change from flying boom to probe-and-drogue equipment to meet the changed operational conditions.

Mr. Ward's reference to assisted take-off from shorter runways has several possible implications: (1) rocket-assisted take-off, including the De Havilland Super Sprite rocket motor which can give up to 4,200 lb. thrust for 40 seconds and then be dropped by parachute to a prepared recovery site; (2) a vertical lift component derived from the aircraft's own power plant through deflectors; or (3) taking off with light fuel load and completing the initial fuelling from airborne tankers. Any combination of these aids to take-off might be used—including all three—to lift a full bomb load from very short runways. The advantage of such aids is very real when new runways have to be made on virgin ground—as the U.S.A.A.F. XXth Air Force discovered when compelled to operate from the unprepared coral rock of the Mariana Islands in 1944 without any such aids.

The final advantage of flight refuelling to the V-bomber force is the increased flexibility of operation which it confers. When a target falls within the normal range of the bombers with full bomb load, all the aircraft can be used in the bomber role. When the range increases, in the past it has been necessary to reduce bomb load in order to increase fuel load; but with the R.A.F. equipment the necessary proportion of V-bombers can be converted to tanker duties, so that the full load of bombs can still be carried by the operational bombers. According to the bomb load and range

involved, it can be shown that fewer aircraft (including tankers) are then required to deliver a given load, and further economy is achieved by a reduction in the total air mileage required for the operation. The precise characteristics of such operations must depend on the aircraft, and the duty to be performed, but we may be sure that these factors have been fully weighed by the Air Staff in relation to the flight refuelled V-bombers and the strategic functions which they are intended to fulfil. The same considerations equally apply to military transport aircraft for groundcrew or troop deployment and the carriage of military supplies.

WEST POINT—THE UNITED STATES MILITARY ACADEMY

By P. G. MACKESY

"THE sooner we get to know as much of these Americans as they know of us, the better it will be for all concerned and many more besides." The speaker was Field-Marshal Sir John Dill soon after his arrival in Washington during the 1939–45 War.

The similarity of the British and American outlooks is a commonplace in public discussions of Anglo-American relations; and in fundamentals it is true enough. The danger of the generalization arises when it is transferred to the matters of detail which are so immensely important in planning and administration. Experience of working together reveals wide differences in assumptions, methods, and conditioning. Much friction can be avoided by reciprocal understanding of the institutions and customs which create the national outlook.

One of the formative American institutions is the United States Military Academy. The military history of West Point is older than Sandhurst's and goes back to the origins of the United States. Situated on the narrows of the Hudson River above New York, and heavily fortified early in the War of Independence, it commanded the great navigable waterway into the interior and prevented the British Army in New York from splitting the rebellious colonies apart. It was West Point which the traitor Benedict Arnold tried to betray to Clinton, when Major André was captured by the Americans and hanged. After independence was won, the fortress contained almost all that survived of the Army, for Congress virtually dissolved it, and all that was left were 80 men guarding stores at Pittsburgh and West Point.

West Point has become a showcase of the United States Army—a sort of American equivalent of the Tower of London and Gibraltar. But it is a great deal more than a showcase, for in 1802, the year in which the Royal Military College was established at Sandhurst, the U.S. Military Academy was founded there with ten cadets.

In the grim, granite barrack-blocks on the heights above the Hudson, to-day 2,400 cadets undergo a four-year course of military education. The Academy thus produces a considerable proportion of the Regular officers of the Army (and hitherto of the Air Force), and because of the strong trades union instinct of its graduates it exercises an even greater proportionate influence on the character of the American officer corps. The importance of the Academy and its graduates in the world to-day, and certain features of the system which are not reproduced in this Country or perhaps anywhere in the world, seem to justify a description of its methods.[1]

Though West Point was founded in the same year as the R.M.C., it bore a closer resemblance to the R.M.A. at Woolwich, founded some 60 years earlier. Until the Civil War, the U.S.M.A. was a school of military engineering, and for many years the only school of engineering in the Country. Its contribution to the opening up of the States was immense. Throughout the long peaceful years of

[1] The writer gratefully acknowledges the information and hospitality which he received from Colonel Lincoln, Colonel Harman Beukema, Captain Robert C. Stender, and other members of the staff of the Academy. The opinions expressed are, of course, his own.

America's isolation, the graduates of West Point laboured in the field of civil engineering, and in 1850 a university president declared that they did " more to build up the system of internal improvement in the United States than all other colleges combined."

From the beginning, high standards were enforced and a serious professional spirit reigned. Perhaps the national horror of jobbery among public servants, born of experience of XVIIIth Century British soldiers and officials, served the Academy and the Army well, though the prejudice did not spill over into political life. The Civil War proved the value of the Academy's training. The Confederates used West Pointers wherever possible; the Northerners employed political generals until defeat after defeat forced them to turn to professional officers, and opened the road of promotion to men like Grant and Sherman.

To maintain that high professional spirit and turn out officers has become an increasingly difficult problem as the years have passed. To instil discipline and soldierly qualities in a Country where youth is so generally indulged seems an almost insuperable problem. The difficulty is accentuated by the diversity of background and quality of the cadets, inevitable in a land of immense distances and under the system of nomination by individual Congressmen. There can be no initial assumption that the cadets and their instructors share a common code of behaviour or standards of responsibility. Uniformity has to be imposed on diversity, and a class created which is isolated because it is not supported by an analogous class in society as a whole.

West Point triumphantly overcomes the problem. The Academy's solution is four years of iron discipline and the imposition of a rigid uniform code on every cadet. To teach him to live and move easily in a diversified society is no part of the Academy's aim—that must be picked up in later life. The life of the cadet is in startling contrast with the relaxed social atmosphere of the colleges in which his contemporaries are growing up. He is never out of uniform except for sport or sleep. He lives a crowded, barrack-room life with no privacy, little spare time, and little social life. His leaves are few and short. The discipline under which he lives is enforced by a rigid ' honor-system ' which makes him his own policeman, and binds his friends to report his lapses if he fails to do so himself—any breach of the ' honor ' code means instant dismissal.

The pressure is greatest in the first year. The ' hazing ' of freshmen survives in many American colleges; but there is nothing to compare with the ordeal of the West Point ' plebe '. Coming, as he usually does, from a day school, he suddenly finds himself incarcerated for 11 months in the barracks and training area. During that time he is broken in to the West Point way of life. Until recently he sat during meals on the forward three inches of his chair, and was forced to eat a ' square meal ', moving his knife and fork at right-angles in horizontal and vertical planes. There are instructors at the Academy who regret the change, and think reform has gone too far; but the strain on the ' plebe ' is still severe. He walks, and stands, and sits at meals, at a ' braced attention ': his chest protrudes, and his chin is drawn into his neck till he seems to have a double or treble chin. At meals he speaks only when he is addressed. All this time he is leading the intensive life of study and physical exercise of which more will be said presently.

The system achieves what is intended. Natural selection weeds out the weak nominees—up to 35 per cent. of every class has dropped out by the end of four years, most of them in their first year. The survivors who are turned out as officers have

undergone an experience harsher than anything known to the men they command or the civilians they will work with. They will have little sympathy with weakness, and small patience with shortcomings. Of themselves they will demand the highest professional standards and the best work their capacities will allow. They have a strong sense of right and wrong, and a belief in success which at times may border on ruthlessness.

Yet one must be careful not to overstate the effect of the system. One's first introduction to the machine may oppress one; but one soon discovers that four years of it do not damage the cadet's liveliness and curiosity, or impair his sense of humour. Even the harassed faces of the 'plebes' will betray a sudden reassuring twinkle.

The West Point curriculum is both military and academic. The aim is to combine the training which will make an officer with a university course which will provide the breadth of vision and knowledge needed by the modern army, with its world-wide responsibilities and its leadership in international organizations like N.A.T.O.

The cadet devotes 43 per cent. of his time to tactics, physical training, and military psychology. The remaining 57 per cent. of the time is spent in academic studies, about three parts mathematics and science to two of history, government, economics, geography, and international relations.

To combine a four-year undergraduate education with professional training is an ambitious aim. Yet a comparison between the examination performances of recent West Point classes and a sample of undergraduates from other universities and colleges shows that the West Pointers were well above the average. Their strongest subjects were mathematics and the physical sciences, their weakest literature (still above the sample average) and the fine arts. In awards of Rhodes Scholarships, West Point stands next after Harvard, Yale, and Princeton.

At this point a warning is necessary for the British reader. An American undergraduate education differs from a British one in standards, aims, and methods. The ordinary American student reaches the university less well equipped than his British contemporary. Very rarely has he specialized at school or done the independent work which alone can fully develop the judgment and powers of reasoning. Usually his high school education has done little to awaken his interest in general ideas. The American college's first task is to awaken his mind by 'exposing' him to a variety of subjects in a general way. The outline course and the study of trends and generalizations takes the place of the detailed factual material to which the British undergraduate is learning to apply his judgment; and when the American emerges with his bachelor's degree his mind is intellectually less mature than that of an Englishman of the same age and equal ability. In civilian life this difference is often made up by prolonging the years of education by graduate work in a professional school.

West Point, then, cannot hope to produce specialists. What it can do is to produce officers with a broad, general awareness of the major problems of their world, and the capacity to develop. In the last few years an effort has been made to increase the traffic between the Academy and the outside world by holding an annual student conference on national affairs, in which students from about 60 universities and colleges mingle with West Point cadets for four days, assisted by about 40 senior participants. While this broadens the contacts of the cadets, it also broadens those of the civilian undergraduates and dispels many of their preconceived ideas about the Academy.

The question which an outsider naturally asks is whether so ambitious and varied an academic syllabus can be combined satisfactorily with military training. Even in a civil university the pressure of work on the undergraduate is very heavy—so heavy that he is often too busy catching up with his reading to have time to think. At West Point this load of work is superimposed on military studies. It is true that the West Pointer does without the long vacations of the universities, yet the pressure on his time is intense, and the rigid discipline and routine, the endless round of drills, recitations, inspections, and gradings does not create an environment which encourages free speculation. If a full university education is indeed necessary to the modern soldier, one is left wondering whether most of the military training should not be deferred until the cadet is commissioned.

To raise this question may betray an academic bias, and such a separation of studies might not be acceptable from the military point of view. Certainly it would sacrifice much of what West Point now achieves in weeding out the misfits and teaching its cadets to think like soldiers. And in its present form West Point is an immensely impressive institution. Its tradition and its methods create a coherence and singleness of purpose in extraordinary contrast to the variety of American institutions and society.

EARLY DAYS OF WIRELESS TELEGRAPHY

A GALLANT FAILURE IN 1903

By Brigadier B. C. Trappes-Lomax, M.C.

FIFTY years have passed since the fourth campaign against the Mullah in Somaliland was brought to a successful conclusion. The two volumes of the official history have long been unopened on the military library shelves. The campaigns followed so closely the pattern of many of our enterprises that this is not surprising. We have long expected the utmost gallantry from all ranks and this was forthcoming in full measure. We expect supply difficulties in inhospitable terrain, and found them. All movement depended on the presence of water and the provision of camels to carry it and the other essentials of a force in the field. We might expect to find that in the first three campaigns we set out to hit a very large nail with an exceedingly small hammer, and in this too we would not be disappointed.

We do not, however, expect to find that in 1903, during the third campaign, an attempt was made to communicate by wireless telegraphy between widely dispersed forces. Wireless was still very much a baby, and it was only eight years since Marconi had sent and received his first wireless signal.

The attempt, however, was made, and is briefly disposed of in the official history. " In endeavouring to establish communication between the two forces, the Marconi system of telegraphy, to work which parties had been sent from England under Lieut. A. E. Silvertop, R.N., was to be utilized." And, " A Marconi installation, under Lieutenant Silvertop, R.N., was attached to the Obbia Force in 1903, and attempts were made to utilize it on the lines of communication. Owing, however, to the characteristics of the country, it was found impossible to arrive at any good results, and the attempt to make use of it was abandoned. The party finally left the force in May, 1903." And again, " It had been hoped that the naval party which had been sent from England with Marconi telegraphic apparatus to both the Berbera and Obbia forces might have been of some service towards establishing communication between the two forces, but the conditions of ground and climate in Somaliland were alike unfavourable, and on the 20th April the Admiralty was requested to recall the detachments."

As so often happens when there has been a failure there were recriminations, questions were asked in the House, and letters written to *The Times*. The Secretary of State for War apparently stated that application had been made to the Marconi Wireless Telegraphy Company for an installation for Somaliland, and Lord Selborne had stated that Marconi apparatus had been tried in Somaliland. The Company concerned, however, stated that they had never been asked for an installation and that their equipment did not go to Somaliland. The apparatus used seems to have been Admiralty equipment.

It is, however, possible to glance at the human side of the failure and to see a little of what the attempt meant to the young officer who had been placed in charge of the experiment, since Lieutenant Silvertop's letters home have survived.

The writer of the letters, Lieutenant Arthur Edward Silvertop, R.N., third son of Henry Charles Silvertop, J.P., D.L., of Minsteracres, Northumberland, was born in 1877 and so was 25 years old at the time of the campaign. His mother, to whom the letters were addressed, was Caroline, daughter of Edward Joseph Weld, of Lulworth Castle, Dorset. He married in 1905 Dorothy, daughter of James Campsie

Dalglish, and was killed in action at Jutland as a commander in H.M.S. *Defence* on 31st May, 1916.[1] He had taken an intense interest in wireless telegraphy from the day of Marconi's first successful experiment. He was convinced that the new invention would revolutionize naval warfare, and equally convinced that the Lords of the Admiralty were not sufficiently interested. It is not surprising that, when it was decided to send W/T to Somaliland, Silvertop should be selected; it being most unlikely that the Lords of the Admiralty were conversant with his views of themselves!

The second Somaliland campaign had been based on Berbera and operated against the Mullah from the Bohotle area. It came to an end with the expensive and inconclusive action at Erigo. The third campaign was to consist of two columns—that already in the field at Bohotle, with its L. of C. stretching back to Berbera, and a new force to be based on Obbia. It is readily apparent that wireless communication between the two forces would be invaluable in co-ordinating action once the Mullah's whereabouts had been established.

On 8th January, 1903, Silvertop wrote to his mother, "I sail on the 16th with some 81 packing cases of my own instruments, six small balloons, cylinders of gas, 1,200 square feet of steel earth plates, etc., from Aldershot; altogether some 120 packing cases of one cwt. each. You can imagine my task to get them all packed and properly marked and organized. I spent all day yesterday at the War Office getting orders and the rough idea of my duties. All today I have been at Aldershot."

One is aghast at the bulk and weight—no less than six tons of material in 120 cases to communicate between forces that were to begin the operation some 150 miles apart. It is no wonder that we will find later a commander, who was perpetually short of transport, looking a little sideways at this menagerie, and we cannot be surprised if friction arose between its owner and the Chief of Staff.

He had been given an outline plan and he passed this on to his mother—security in regard to operations is a modern innovation. "Roughly this is the plan. I and two warrant officers, two of my torpedo instructors, two sergeants and four men of the Royal Engineers form my party, with four more from the East India Squadron if I want them. We go to Aden by P. & O. There we divide in two, Mr. Kelsey, my Portland friend, goes in command of half to Berbera, which is the starting point of one column. I go with the other half to Obbia . . . General Manning is there. Leaving our reserves at our respective bases, each column goes some eight days' journey into the desert, everything on camels, and form two advanced bases. These will be about 150 miles apart. The Mad Mullah is somewhere in the desert between. At each of these advanced bases one set of instruments is permanently set up. Then I, from my side, and Mr. Kelsey from his, have to go as far as we can into the desert towards each other (say 25 miles) where we set up the other sets and remain with a guard. These two sets should be in communication with each other, about 90 miles apart.

"Reconnoitering parties then go out and look for the Mullah, and on finding him we must signal his whereabouts and movements to each other. If we can, it will mean his certain capture. It is a glorious chance for me. Unfortunately the climate is utterly against success. Also having to take the delicate instruments on

[1] His only son, Lieut.-Colonel David Arthur Henry Silvertop, D.S.O., M.C., 14/20th Hussars, was killed in action when commanding the 1st Royal Tank Regiment east of Antwerp on 25th September, 1944, and a street in Boom has been named after him.

camel back. But I need not say I will do my utmost. The whole thing is only looked on as an experiment, so if I fail it won't matter so much." He was to wear military uniform and the War Office had agreed to pay him what the Admiralty considered 'reasonable'. The letter ended with the caution: "Don't go and show this to anyone."

If we are appalled at the equipment to be taken we must admire the optimism that considered one officer and 10 to 14 other ranks sufficient to instal and man no less than four stations. The commander and his Chief of Staff can surely have had no complaints on this score.

Silvertop and his half of the establishment arrived at Obbia on the morning of 7th February, after five days from Aden in a 300-ton native steamer. It was a change from the voyage out with its 6 a.m. run round the deck, followed by half an hour's dumbells on the bridge. There was a party in Marseilles with the Wicklows, "a young newly married couple", and an evening with "Lady Constance" at Port Said which, it seems, equalled if it did not surpass Marseilles. But there is a more serious note, "I feel as if I had the credit of the Navy in general and the torpedo service in particular on my shoulders."

He found time to write from Obbia on the day he landed, "Got here this morning after five awful days in a little native 300-ton steamer. Very rough. Ship filthy. Surf very bad on landing. I came with eight camels in a surf boat. Stores not yet on shore. . . . Dazzling white sand stretching right away inland out of sight, getting browner as it recedes. No beach vegetation of any kind. Tents of every shape and size. Camels everywhere. Men of every colour and nation swarming about. Intensely hot sun blazing down. Glare awful. Sand everywhere and in everything. Turquoise blue sea and white surf. Two mud huts and one square one-storied building. No one seems to know anything about me here. . . . I had to forage about for rations, cook them ourselves, get our water; the well for all these thousands is a little muddy, brackish hole in the ground."

"A start cannot be made for long yet. No camels to be got. But I am shortly going about 40 miles inland, I think with a reconnaissance party to be a sort of advanced depot to signal back to here. But I know nothing yet. Mail just off. In May, communication with this place ceases as the surf gets too bad. But we ought to have joined hands with the Berbera party by then. . . . Send cigarettes sometimes."

Four days were spent at Obbia getting the instruments ashore and overhauling them. One of the most important pieces had arrived broken and sand got into all of them. For the moment optimism faded and, "I told the general I was very doubtful if the instruments would work."

On 11th February, Silvertop and five men, with one set of instruments, moved out the 11 miles to Gaberwein, with 14 camels and ten days' water and rations. "This is an entrenched post, one of three extending 50 miles inland at which stores are being collected for the column's advance in ten days time. I have a nice horse but they won't give them to my men (the only white men not mounted), so as I am a good walker I have turned it over to them to share. We left Obbia at 7 a.m. and got here at noon. The walking was awful. Only 11 miles, but in sand over your ankles and the heat after 10 a.m. very bad. I walked all the way but wasn't much done. One of my men got a slight touch of the sun. We had no breakfast and it took us from 4.30 till 7 to get loaded. Instruments very awkward to load and getting very knocked about. Infernal camels kept lying down. Brutes they are."

" We are here in a thick thorn and barbed wire zariba with a Sikh guard. No tents, but we manage to rig up a little shelter from the sun. I am only waiting here for a convoy. I go on another 13 miles with a night convoy and escort tomorrow night to Lodobal, a similar place to this. There I fix up my instruments and make a desperate effort to communicate with Obbia. If successful, I move on again. If not, after a week's trials, I fear I shall be sent back. Everything is against success. I can't get my wire up properly. Everything full of sand. Ground baked dry. Instruments jolted to pieces. I'll have a jolly good try."

" The heat, hard work, and life in general suit me amazingly and I'm awfully fit. Food monotonous. Preserved meat, raw tea, jam and dried figs, onions, flour, and water. Sand flies awful. I'm thoroughly enjoying myself though, if only my gear will work. Shooting in glorious profusion, koodoo and three or four other sort of antelope at 600 yards this morning on the way up. If the gear works I shall await the column's arrival at Lodobal and then go with it to Mudug. They expect a fight before getting there. The blamed admiral has stopped Mr. Kelsey at Aden and sent the torpedo lieutenant of the flagship. I have complained and protested through General Manning to the Admiralty."

The next letter is from Lodobal, where he and his party arrived after an unpleasant march of seven hours. And to make matters worse, a 24-hour attempt to communicate with Obbia failed. " Could only discover what is wrong by experimenting in the *Naiad* (a naval ship lying off Obbia). So rode back to Obbia by myself. Took 12 hours. Only 25 miles, but heat and heavy sand so bad horse can only walk. Had 12 hours there, found out fault, rode back 12 hours, pretty well done. This morning (17th February) got my instruments correct. But I can't get a sign of a signal after trying all day. Miserable. Only reason I can think of is the hills in between. Must ride into Obbia again and try and get a section set up on a hill. Must do it somehow or have failed. The worry is very trying but am not beat yet and am very fit physically. Beard doing nicely. Am greatly handicapped by want of a servant. Last five nights have slept on a sheet in the open and haven't had clothes off. Nights cool, but very hot in the day. Insects awful. Centipedes, scorpions, snakes, and large spiders. Good shooting if I had any time. Five of our Somali spies sent out from the next zariba met 30 enemy about 20 miles from here and lost two killed and came in very excited."

On the 18th he wrote, " My instruments in splendid order but no signal. Will ride into Obbia and tell the general only fault is intervening hills and persuade him to get my other section up country. Transport though is shocking hard to get. . . ." And on the 19th, " Rode in yesterday in eight hours. Saw general. He says he won't take me unless I give proof that the gear will work, so I shall bring my Lodobal instruments in quite close and show. Shall ride back today."

But on the 25th he and his instruments were still at Lodobal. " I am absolutely held up here for lack of transport. After twice riding 50 miles to Obbia and back by myself I managed to receive signals from there but not to send them back. . . . I told the general that, and that I had both sent and received messages over seven miles (which was as far as some mules I had looted could carry the instruments), but he told me that camels were so scarce and valuable that he can't take me up without practical certainty that I can signal across to Bohotle later on. But he said I could go on to Dibit, 35 miles inland from here, and bring the Obbia instruments here and that will give me a fair trial I admit."

"The general and about 500 men passed here yesterday on their way up to occupy Mudug. I was very sick as I ought to be with them, but the main body won't join him for 10 days, and by then I shall have brought off my trial. Either succeeded or failed. If the former I go on with them and eventually march across the desert to Bohotle and out to Berbera. If I fail I take the instruments back to Obbia. But I think I shall get the wireless through. I have learned a bit about kite flying and other troubles, and I was only jammed before by the hills. . . . I don't get on very well with the chief staff officer, as I have been having fearful arguments with him about transport, I standing up for myself and he wanting me to give up. But if I get through this next trial I am all right. I am now waiting till my Obbia gear arrives when I go on with the camels to Dibit."

On 5th March they reached Dibit, taking 48 hours to do the 33 miles. This slow pace was mainly due to the exhaustion of the camels. "The instruments are now being erected for the final trial with Lodobal. I am not sanguine as the ground is rock here and I can't get an earth connection. This is the most advanced zariba 60 miles from Obbia. The general and his force are 60 miles further inland. . . ."

He was still at Dibit on 13th March, "I think I have touched the acme of discomfort. You can have no idea of what a beastly existence it is. As regards my work . . . I at last succeeded and got several signals through and answers between here and Lodobal 33 miles, thus fulfilling the test. Since then I have been waiting for transport and doubt if I shall ever get it. We are rather in a bad way. The flying force with Manning up country is very hard up for food and water. The main body which reached here a few days ago and was to have gone on at once has had to wait here and send on 700 camel loads of food. The presence of this force here has dried up our water and we have been for some time on a gallon a day for all purposes. By the time cooking water has gone there is not enough left to satisfy thirst in this awful heat, and I've not washed for a week. However, I don't want to growl and the chief trouble is no shelter from the sun . . . I am awfully fit."

"The transport question is very serious and I certainly shan't get my gear taken up yet. Rather curiously, Melton Prior happened to be looking on at Lodobal when the first message arrived, one that I had sent, saying 'Inform Colonel Fasken no water at Aolu', Colonel Fasken being in charge of the main column and being about to march to Aolu. Melton Prior has drawn the whole thing full page and sent it to *The Illustrated London News*."

"In the meantime I am doing helio work and have been trying to get communication with a place 20 miles up country. For that purpose I went there and back yesterday. I left here at 10 a.m. yesterday and got back here at 2 a.m. this morning—16 hours during which I rode 30 miles and walked 10; not bad, was it? It's funny the way one rides about here by oneself by day or night, as if there was no such thing as an enemy. We certainly have none near here. One is a quaint sight on a horse—like the White Knight—rifle, revolver, cartridge belt, water skin, bag of corn for horse, blanket, bag of food for self, compass, etc. It's very nice riding at night if there is a moon, or one is apt to lose one's way. The only way of finding your way is by following the track of the last camel that went up. As a matter of fact the tracks are getting well worn now."

"My plans are vague. Either I get transport and go on, eventually emerging at Berbera end of May, or if I can't get transport the instruments will be re-embarked by middle of April and go to Berbera by sea. . . . I may manage even in that case

to pick up a job that will take me on with the force. Shall soon have rains and plenty of water."

Three days later he heard that the officer-in-charge, L. of C., would be at Lodobal on the 16th, so he started off on his horse at 9 p.m. and rode right through, arriving at 7 a.m. Whatever the army authorities might be thinking about W/T, at this time they could hardly accuse its owner of lack of initiative. It was decided to send the instruments at Lodobal to Obbia to be embarked there for Berbera, and Silvertop and his Dibit party was to proceed up country in about a week's time.

Colonel Rycroft, who was commanding the L. of C., would not let Silvertop return to Dibit next day as he had intended, but ordered him to stay a week at Lodobal and take part in camel raiding. As a result of two raids 24 camels were acquired and 17 of them allotted to him to take back to Dibit. For a week he had been parted from his kit, and had nothing except what he had ridden down in. In spite of the fairly bright prospects, he was not happy. " I fancy that the chief value of my instruments has gone now, not that it's my fault, as I could signal if they had given me transport, and I have done 33 miles. I am unpopular with the general and his staff, but I don't care tuppence. I've done my best and shown I can signal, and it's not my fault that I have no transport. And I've got priceless experience."

On 23rd March he writes from Lodobal, " I am off at daylight tomorrow with spare stores, and on reaching Dibit pick up the party and instruments and go right on through Galkayu to Rhor, only 60 miles from the other instruments. Hurray! After all my struggles to get on! It's a ride of about 140 miles, with camels at two miles an hour, which will take me nine days I expect."

He got to Dibit, but this new-found optimism was to be rudely shattered and he was still at Dibit on the 31st March. " Here I am jammed again. I was just going on when orders came that I was to remain and a hospital section go on instead. Transport is very bad and all our few camels dying. It's sickening fortune for me. If they don't want me, why did they send me? It's the worst organized show I ever heard of. Transport hopelessly broken down and all manner of things stuck about on the lines of communication unable to get on. I am just chafing here doing nothing."

But he had made himself reasonably comfortable. An almost sun-proof hut, six foot by four, had been built and the only other officer in Dibit had an excellent cook. And with the increase in comfort, he looked forward to the future—a Turkish bath, a sleep in a bed, and a bottle of iced champagne. He had become attached to his horse and trained himself to be ready in ten minutes for a two-day trip. And he had real hopes that he would be moving forward on 2nd April.

And move he did. The 100 miles to Galkayu were covered in six days. But his reception was not encouraging. Galkayu wanted rations and not wireless stores. He was refused transport to go further. On arrival he wrote in dejection to his mother, " I am just about as depressed and sick of everything as I can be. . . . Left behind, given no transport, doing nothing but eat valuable food, and everyone no doubt thinking me an utter idiot, not having the facts of the case, and when I at last get up here and only want to get 50 miles further to have a chance of signalling to my party at Damot, I am roundly abused for coming, or at least given to understand that I'm a damned nuisance, as they wanted food instead, and refused transport to go on, so here I am jammed again. Colonel Fasken (in command at Galkayu) is sending to the general to ask for orders concerning me."

" So you may imagine how sick of life I am, and I have a horrible depression which is always weighing on me. Of course I foresaw all this trouble as I told you at home, but it is none the less hard to bear. And then I have the ever present dread that when I do finally get to the right place I may not get signals, either from natural difficulties such as hills and gales of wind, or the other party may have gone wrong, and my instruments are an awful anxiety on the march. Any one of the delicate things in my 20 cases getting broken, and I'm absolutely done."

The cares of being the sole support of the new invention would have weighed heavily on any young man but on none more heavily than they did on this unfortunate naval officer who believed so emphatically in its present and future uses. And to make matters worse for him, the Army that he was endeavouring to help was unsympathetic. And who can blame the Army ? Every camel was needed for the carriage of rations, ammunition, and water, and the thousand items of stores without which an army cannot remain in the field. Who, when fighting under the most difficult conditions, could conscientiously sacrifice one bullet, or one medical necessity for the wounded, to this bulky equipment, the successful working of which to even the most optimistic was highly problematical ? But to the young naval officer it was the great experiment that counted to the exclusion of all else.

His mother had evidently replied to his account of the evening in Port Said on the journey out. He writes, " How amusing about Lady C.M.[2], but I'm not surprised. She wanted to come with me dressed as a man as one of my wireless party. I hear she has turned up at Berbera and is working inland shooting, so perhaps I shall meet her."

He was still at Galkayu on 13th April, but with the adaptability of the Navy he had found something to occupy his time. The commander at Galkayu had gone off for a week and handed over to Silvertop pending the arrival of a new commander. " It is surely the strangest command a naval fellow ever had. It consists of half a dozen wells, a zariba of about five acres surrounded by walls, thorn, and barbed wire, 40 Bombay Sappers (Indians), 25 of the 2nd Sikh Infantry (Sikhs), 25 of the Uganda Rifles (Africans), 20 of the Biccaneer Camel Corps, who are volunteers lent by the Maharajah of Bikaner, and about 150 followers and natives of various sorts (Indian and Somali). Did you ever know such a collection. They are all different castes and speak different languages, and though I have an interpreter, it's hard work. Then there are hundreds of sheep and goats and a floating ' hanging on ' of starving Somali families. My duties are primarily the defence of the camp with pickets and sentries, etc., sanitation, looking after wells, providing escorts for convoys, post office, and rationing the various people and seeing they don't get too much. It's uncommonly hard work, but I am very glad to have it. Don't look on it as a compliment. It is always done by a subaltern and I am only doing it because there is no one else."

He had collected, from a party of Somalis who came in to surrender, two small boys, clothed them in an old vest apiece, and made one his groom and the other his servant. They learned quickly, and added much to his comfort. He had decided that the zariba was too big to be defended by the garrison and reduced its area by one half. And he had made the important discovery that the well water lost its taste and smell of bad eggs if exposed to the sun. During the day his bath was in use as a water refiner.

[2] This was Lady Constance Mackenzie, daughter of the 2nd Earl of Cromartie, who married Sir Edward Stewart-Richardson, 15th Bart.

On 19th April he reported the end of his experiments. He had heard that the instrument at Damot under Kelsey had been withdrawn to Bohotle, " as they were unable to signal between those two places and there was a great scarcity of water at Damot. . . . So it must be written down a failure . . . I see no reason to doubt that I could have signalled from Badwein to Damot had I ever been given the transport to reach the former, and had Mr. Kelsey been allowed to remain at the latter. As it is, the object has not been fulfilled, and doubtless it will go against me, but I don't mind and am personally conscious of nothing left undone on my part." He worried that the general will think him a fraud and report accordingly. But with the passing of his signal commitments he had drawn closer to the Army, and reported that he had made great friends with many of them. If it was difficult to accept him as a means of communication, the Army was beginning to realize that he had his place as a soldier.

He continued to command the camp at Galkayu and was kept so busy that he had little time to think of his failure. Galkayu was becoming a fair-sized depot, as stores were being moved up from Obbia; there were innumerable administrative duties to be carried out. " I only write in detail like this because it is all such new work to me. And the beauty of it is that, by King's Regulations, a naval officer on shore is not entitled to give orders to any soldier whatsoever. I am awfully fit and well, and my young servant is a great blessing. I am very anxious about my horse which is getting very thin. I think it is the sulphur water." He had also found a valuable ally in Major R. G. Brooke, of the 7th Hussars, who was in command of the L. of C., and he was full of hope that he would be allowed to remain in command of Galkayu.

He was always doing something, and on 21st April wrote that, " while gazing at the numerous pigeons, grouse, and guinea fowl which come and drink at the well, and wishing I had a shot gun, I bethought me of a trap which Ridley showed me how to make at M.A. (this was Minsteracres, his father's home in Northumberland)." Action followed thought, the trap was made, and the first day the bag was seven grouse and 51 pigeons. An aviary was constructed and the birds killed as required for food.

One of his bothers was the number of Somalis who hung around the camp. Warnings were no good, so he caught six of them and gave them two dozen apiece with a sjambok. This was not enough and he took to taking pot shots at them, carefully missing by a few yards. This seemed to have met with some success. He ignored the general's orders, " that all such were to be shot without any missing about it."

On 22nd April he reported, " some rather grave news from the front in the shape of a letter to the various officers commanding posts, saying that a certain body of the force had met with a check and warning us to be extra careful." This was the first news of the destruction of the force under Lieut.-Colonel Plunkett, with a loss of nine officers and 187 other ranks killed and 29 wounded, at Gumburu on 17th April.

This news was somewhat offset by the discovery that one thing of use grew in this inhospitable country. A large root, " which forms a most efficient and delightful soap especially for washing clothes. It leaves a splendid fresh smell on them like lavender."

On 24th April there was more news from Gumburu. " You will have heard of the disaster to a section of our force. Ten officers (the official history gives nine) and

nearly 200 men wiped out. It happened 20 miles from here. The news reached me the night before last. It briefly gave the details which I immediately forwarded on trotting camels to Bohotle, whence it could be wired home. It warned us to expect attacks and left us in a ticklish position, as we did not know if Manning would succeed in extricating Cobb or not. I have spent the hardest 48 hours of my life, I think, in doubling our defences and making every preparation. Isn't it an odd position for a sailor to be in? Senior officers passing through don't take command."

While writing his letter, news came in that Cobb had been successfully extricated and that General Manning was withdrawing on Galkayu and was expected the next day. He again deplores the losses at Gumburu but adds, "thank goodness things will be a little more exciting now." The Navy was getting over its disappointments in the possibility of action, but there was a warning note, "our ammunition is dreadfully short owing to lack of transport."

On 26th April he reported that General Manning was in his camp and that 400 more men were expected the next day. "I am most awfully busy increasing the zariba again and making ready for them. . . . The general has ordered me and my party to proceed to Bohotle and back home, but Major Brooke has strongly urged our being kept. I hope we may be. I don't want to go home before having a slap at the Mullah."

As he wrote he was informed that the general had agreed to let him stay with the expedition. This seems to have been entirely due to the good offices of Brooke. "So I pack up all my instruments and turn into a soldier pure and simple. . . . The programme is this. We have left a strong garrison at Galadi and we all sit here and use all our camels down the line, bringing up stores from Obbia. When it is all up here and all the various posts at Lodobal, Dibit, etc., abandoned, we will have food till 4th June, but shall get more from Bohotle. When, as I say, everyone is here, then we go for the Mullah again with, I hope, better success. I shall now thoroughly enjoy myself. I have plenty of work I can do."

But he was to remain at Galkayu only till 15th May, and handed over his command there on the 14th. On 1st May he reported that they were in a state of suspense, as no news had yet come through from England with instructions as to what the expedition should do. "It is quite incapable of proceeding against the Mullah without reorganizing and reinforcing."

However, his finances were satisfactory, for besides his own naval pay he was getting an extra 8s. a day and a further 9s. a day while in command of the zariba. He remained busy with his camp and reported the passage of the Boer contingent on its way to Bohotle. His horse was a worry: "I have been nursing him as I can't get another if he dies, and I don't want to walk the 150 miles to Bohotle." But he was fit and had put on eight lb. in weight. A dic-dic had been found and followed him about everywhere.

The Admiralty had been asking for his return and he expected to go to Bohotle and Berbera with the next convoy. He feared an epidemic in the camp, two white men had already died of enteric. "I am nearly off my head with worries. In the last three days over 1,000 camels with stores, 500 mules, and 300 troops have arrived and left again, all having to be watered, fed, accommodated, sent off again with proper rations and water, dying animals shot and burned, and countless worries. . . . I never get one thing finished before another crops up. I sometimes drop everything, clear everyone out, and go and shut myself up in my hut and think of absolutely nothing for an hour, and then start again with my head a little clearer."

On the 15th he started off in a convoy to Bohotle. "Major Kenna[3] commands us and you couldn't find a better." On the 23rd he arrived safely at Bohotle. His horse had died before setting out, "but I have got the remains of another which will, I hope, take me to Bohotle." Somehow it did, and Bohotle was a paradise. A lake of rain water, bread, and a few tinned things to be bought, and, "I got a bottle of beer."

He was at Bihendula on 4th June, some 20 miles from Berbera. The march through had been trying to all and he had had to shoot two of his camels and leave the instruments they had been carrying by the roadside. He reached Aden on the 10th, having handed in all his stores at Berbera and "got receipts." He sailed for home on the P. & O. *Oriental* and spent the time writing his report to the Admiralty, where, one hopes, it still reposes among the archives.

[3] Major P. A. Kenna, V.C., 21st Lancers; killed in action while commanding a Brigade at the Dardanelles, 30th August, 1915.

THE YELLOW PERIL—IS IT REAL?

By Wing Commander E. G. F. Hill, R.A.F.

FOR many years past, people have talked glibly of the yellow peril, the danger that the yellow races may one day outnumber and wipe out the white races. The immense scientific and industrial superiority of the white races, however, pushed any fears of such an eventuality into the background until Japan began to absorb western ideas and scientific methods, and the threat became a reality. What happened in the case of Japan has passed into history, but a new and potentially far more serious yellow peril has now loomed with the emergence of China as a world Power. Even more threatening in western eyes is the present alliance between the new China and that other danger to world peace, Russian militant Communism.

The example of Russia's rapid development from a feudal and agrarian country to a great industrial power serves to emphasize western fears concerning China. If the same rapid industrial development should take place in China, and power should be added to the countless millions of Chinese elbows, the whole world balance of power might be radically upset. It is, therefore, essential for the western nations to examine closely these possibilities and to attempt to forecast their effects. An accurate assessment is vitally important to the formulation of long-term foreign policies.

Firstly, can China become an industrial nation, and if so, how long is it likely to take? Progress has already been made but large scale industrialization of any nation involves certain prerequisites. Raw materials must either be indigenous or readily importable. In the latter case, the importing country must be prepared to export either finished goods or other products to pay for essential imports. Power, either mechanical or electrical, is another prerequisite and, in itself, requires natural resources of one sort or another. Manpower, and especially skilled manpower, is essential. Moreover, manpower must be directed, supervised, and organized by experienced leaders with adequate knowledge. Transportation facilities are needed to bring together to the place of manufacture raw materials which may be scattered far and wide, and to distribute the finished products. Lastly, much will depend upon the enthusiasm of the people and the determination of the country's leaders to carry out an industrial programme.

What then is the position in China in regard to these essential ingredients? Accurate statistics are difficult to obtain since the Communist regime took over control of the country. But from previous knowledge coupled with official Chinese announcements which are made from time to time and frequently appear to be exaggerated, a fairly comprehensive picture can be built up.

On the raw material side, coal, iron ore, and oil are undoubtedly the most important items. Large deposits of good quality coal are known to exist in China, mainly in Manchuria. These have been estimated at 262,941,000,000 tons, sufficient to support industrialization on a large scale for many generations. Thanks largely to Japanese activity in Manchuria when that country was under Japan's domination, a thriving coal mining industry already exists. Output in 1940 was in the region of 40,000,000 tons, but dropped thereafter. Estimated output in 1952 was only 20,000,000 tons. However, it can be expected that a figure of 45,000,000 tons annually is well within reach and may by now have been attained. This is not a

great quantity by western standards, but is sufficient for China's needs at present. As these needs grow, there is no doubt that they can be satisfied from the vast reserves available.

The position in regard to iron ore is not nearly so satisfactory. Substantial deposits are being worked, but as far as is known for certain, they are not sufficient by themselves to meet any substantial expansion of industry. A Government spokesman announced in January, 1953, that vast new deposits had been discovered in the Lungyen area of north-west China. The planned construction of a railway link from Peking to this area lends credence to this report, but the extent of the find is uncertain. It must be remembered, however, that more deposits may well be found in areas yet to be prospected. It can, therefore, be expected that the present output of 2,000,000 tons annually will be increased appreciably, but it does seem possible that iron ore is one commodity which China may have to import if she is to expand industry in the future.

Up till recently China has relied upon Russia to meet her deficiencies of oil, but there is evidence of a marked improvement in output from resources within the country. Oilfields have been discovered in the north-west and the search for further oil deposits is being vigorously pursued. Geological studies show that much of China is potentially oil bearing. Even if natural resources should prove inadequate, there is always the possibility of synthetic production from the abundant supplies of coal. It does, therefore, seem likely that any industrialization of China would not be retarded by a shortage of oil.

Following the basic raw materials are many others no less important to industrial independence though not required in such large quantities. Tungsten, bauxite, manganese, lead, zinc, mercury, tin, antimony, copper, sodium, potassium, and rubber are examples. Of these, China's main shortages are bauxite and rubber. On the other hand, she is very rich in tungsten and produces nearly 40 per cent. of total world supplies. China's wealth of this valuable steel hardening metal is greatly in excess of her own likely needs. The surplus is a useful bargaining weapon for any raw material shortages which may be difficult to obtain.

Taken as a whole, therefore, there is little reason to suppose that lack of raw materials is likely to prevent a substantial measure of expansion of industrial development in China. The only doubt of serious magnitude is the supply of iron ore. If this can be overcome, either by new discoveries or imports, it would appear that supplies of raw materials will not be a limiting factor to further industrial progress.

Power is the next item on the list of prerequisites. Here China is extremely well placed. Over and above her supplies of coal and oil from which power can be produced, China has many large and swift-flowing rivers. From these, hydro-electric power can be developed on a scale only limited by the time, effort, and ability required to build dams and generating stations, and instal power cables. At present, although the essential needs of the moment are adequately met, little has been done to exploit this potential. But the potential exists and it can be confidently expected that power resources will be developed to satisfy any demands made.

Manpower must now be considered. At first glance, it would seem that there is no need to look further than population statistics, even though these vary from a fairly reliable figure of 480,000,000 to Government sponsored estimates of some 600,000,000. It is not, however, quite so simple. The pressure of this enormous and

apparently ever increasing population is almost as much an embarrassment as an aid to industrial expansion. Whatever industrial progress has been made to date in China and may be made in the future, the economy of the country is basically agricultural, and the land absorbs 75 per cent. to 80 per cent. of the population.

No examination of industrial possibilities can therefore be made without considering agriculture. In the past, the land has produced barely sufficient to support the lowest possible standard of living for the masses of the Chinese people. Many factors have combined to prevent any improvement of this state of affairs. Most important is the fact that China is very mountainous and only about one-seventh of her land can be cultivated. Other factors include the centuries-old practice of dividing land between all the sons of a family, leading to small, uneconomic farms. Ignorance of scientific agricultural methods has kept crop yields at a low level, and the absence of mechanization has made labour economies impossible. Inadequate irrigation has resulted in droughts and floods which even today take an enormous toll in human life and damage to land and crops. All these circumstances create problems which must be overcome if the land is to lose workers to industry and, at the same time, continue to provide food for an increasing population. Certain measures to overcome the difficulties are already being taken. Vast irrigation schemes are in hand, and collectivization of small farms is in progress. Some small degree of mechanization is being introduced. It will, however, take many years before these measures can make any substantial improvement in the food situation, especially if the population continues to increase. Any expansion of industry with consequent demands on labour will therefore be to some extent dependent on progress in agricultural modernization. This is not to say that industry will suffer from any actual shortage of labour : the labour is there in abundance. A fine balance between the conflicting requirements will have to be preserved, however, if the standard of living of the people is to be maintained until such time as the benefits of industrialization begin to take effect. The effect is more likely to be a slowing down of the rate of industrial progress, and there is a danger to the regime if the pace is forced at the expense of the agricultural community.

So much for the availability of labour, but modern industry needs skilled workers and men of advanced technical and administrative ability to direct them. This is where China's ally, Russia, is playing a major part. To make good native deficiencies, large numbers of Russian technicians have been made freely available to China and facilities have been provided in Russia for the training of Chinese in modern industrial methods and science. From this latter source will come the leaders and instructors for Chinese industry. Doubtless lack of experience will lead to many mistakes and inefficiency, but history shows the Chinese to be an ingenious and industrious people, of great achievement in different fields in the past. If these natural attributes are combined with enthusiasm to learn in the new field of industry, there will be no lack of leaders to retard progress in China. A similar situation can be expected with lesser grades of skilled workers. In the past, the obvious drawback to the training of large numbers of skilled industrial workers would have been the high degree of illiteracy and lack of education of any sort. Today, however, education in China has undergone a great transformation. It started in the 1920s when a simplified written language was introduced. Progress was slow at first, but the new language gained popularity, especially under the impetus of war, and in the past few years great strides have been made. In 1952, there were nearly 50,000,000 pupils receiving primary, secondary, and higher education. All evidence suggests that

further progress has been made since then, particularly in the numbers of students at technical colleges throughout the country. Against this educational background, there can be no doubt about the ability of the Chinese to acquire industrial skills.

Transportation is at present a grave weakness in China's economic structure. If full use is to be made of the natural resources of the country to develop industry, transportation facilities must be at least trebled. New railway lines and motor roads must be built and existing ones extended. Extensive east-west inland waterways already exist and are supplemented by a long coastline, but more power-driven shipping is a vital necessity to exploit these advantages. Once again, however, there is every indication that China's leaders are fully aware of these shortcomings and have embarked on plans to overcome them. An example of this was a report in 1953 that the first locomotive ever built in China had gone into service, and all new railway lines were being locally made. Much remains to be done and will take time, but the importance of adequate transportation is not being overlooked and improvements will greatly facilitate industrialization.

Now to turn to less tangible factors involving the will of the people of China and the determination of her leaders concerning industrialization. About the latter, remarks already made will have shown that China's leaders are set upon building up industry in the country. But the extent of this determination has not been emphasized. Whatever their motives, China's present Communist leaders know that the country can never become prosperous, powerful, and economically independent without industrialization. They have announced a five-year programme which aims at increased productivity and construction, with particular emphasis on all the essential elements of industrialization already described. In this task, they have the backing of the great majority of the intellectuals and the newly-educated youth of the country. The impact of western civilization, slowly growing since 1900, has at last, with the stimulus of 14 years of war with Japan, convinced the Chinese people of the importance of industrialization. This same stimulus, together with factors common in other backward countries today, has enhanced national pride and united China to an extent unknown for over 2,000 years. Perhaps even more important, the people now realize that living standards cannot be raised without industrialization. It is not, therefore, surprising that all reports of present-day China, both authentic and otherwise, speak of feverish activity and drive towards industrialization of the country.

To a greater or lesser extent then, all the prerequisites of industrialization are present in China. There are some flaws in the overall picture, but no real gaps. The greatest danger possibly lies in overtaxing the goodwill of the agricultural community on whom the regime was founded. To imagine, however, that the leaders do not appreciate this danger and will take any risk with it is very probably wishful thinking.

Having dealt with the essential ingredients, the next question to be answered concerns time. How long will it take to turn China into a world industrial power? Before reaching any conclusions based on the foregoing, it is essential to examine the present position. Prior to 1940, the Japanese had made considerable progress in exploiting the natural resources of Manchuria and building up heavy industry in that region. The nucleus of a formidable industrial complex existed and employed local labour in substantial numbers. In addition, light industries, mainly textile manufacturing, had grown up around the great cities of the Chinese coastal plain. During the war with Japan, patriotic Chinese technicians migrated from Manchuria

into western China, moving with them plant and machinery. There, makeshift factories were set up and a basis for future development was established. In 1945, the Russians completed the process of stripping industrial Manchuria with a thoroughness which was absolute. Since the Communists gained power in China, however, industrial Manchuria has been completely re-equipped by Russia. Expansion of industry in China proper has also been carried out largely with Russian capital equipment, and under Russian supervision. What Russia's exact motives are, and how far she is prepared to go in this apparent altruism, is difficult to ascertain. It is clear, however, that a degree of industrialization already exists in China which is, for the time being, closely geared to Russia.

China's relations with Russia are therefore a most important feature in forecasting the speed of Chinese industrial progress. The ability of China to industrialize is indisputable, but she needs capital equipment of all kinds, as well as technical advice and some commodities to carry out her programmes. If Russia continues to render assistance as at present, China will be well on the road to industrialization within about ten years. As transportation facilities increase, the rate of progress will be speeded up. In a further 15 years, China should be standing squarely on her own feet as a first class industrial Power.

On the other hand, if Russia were to curtail or stop her aid, much would depend upon the nature and extent of the stoppage. A complete break would cause a sharp setback to Chinese progress. Such a break might be the result of a political dispute, in which case there is a possibility that the western nations would fill the gap. Left completely to her own devices, however, China's progress would be much slower. The process of increasing output of raw materials, constructing roads, railways, and shipping, and manufacturing heavy capital equipment would be laborious. Inexperience and lack of knowledge would lead to costly errors and inefficiency. In these circumstances it might take as much as twice as long for China to reach industrial maturity.

As a basis for further study, however, it is assumed that industrialization of China continues to progress with outside help over the next 25 years. Whether the forecasts already made are accurate or not, it can be stated confidently that Chinese industrial power will by then have reached formidable proportions. How will this affect the present balance of power between the great nations of the world? Once again, the answer to this question depends mostly upon Russo-Chinese relations, but it would be as well to examine the present and immediate future position first.

The present regime in China came to power by force of arms, backed by the goodwill of the country people to whom promises of better times were made. After long years of national and civil war, it is natural that the regime's foremost aims should be to consolidate its position, both internally and externally, by building up military strength. To this end, a large proportion of the industrial drive is devoted. The urge to increase military power quickly may indeed be responsible for the aggressions of recent years. These aggressions may be an attempt to secure increased food supplies and so release labour from agriculture without the need to impose unpopular measures on the farming community. It has already been mentioned that the dilemma of maintaining a balance between the labour needs of industry and agriculture was a possible drawback to rapid industrialization. Conquest of rich food-producing areas would provide a short cut answer to this problem.

The leaders of the new regime in China no doubt realize that their present aggressive policy runs the risk of provoking action from the western Powers with

interests in South-East Asia, particularly America. It is a calculated risk, however, which they can afford to take whilst they have the backing of Russia. The fact that they may be instruments of Russian far-eastern strategy is probably fully appreciated. For the time being, however, any policy which eases problems of industrialization and, as a result, facilitates the growth of military power, is a worth while risk to China. As she progresses in these two fields, so the threat to her independence lessens and her national status grows. This is in keeping with the new-found Chinese nationalism, quite apart from any possible personal ambitions of her leaders.

Thus it can be seen that already China's actions are threatening western interests and causing some diversion of western military power. But the Chinese threat is confined to the land mass of South-East Asia. China's naval strength is very small and her air forces have no strategic offensive power. Until China remedies this situation, her effect on the world balance of power is limited. Even so, the danger to India, Burma, Malaya, and South Korea is real enough to cause considerable concern. There is a definite need for the western nations to maintain much larger military forces in South-East Asia than would otherwise be necessary. To this extent, therefore, China is already having an influence on the distribution of world forces.

So much for the present and probably the immediate future, but what of 25 years hence when China becomes, as is assumed, an independent industrial Power? As has already been said, it depends largely on the continuation of the existing alliance with Russia. At present, the two countries are bound by common ideological and national interests. A study of history however, particularly recent history, shows that common or opposite ideologies are quickly forgotten when national interests are involved. What if Russia finds that her puppet has become a colossus? What if Mao Tse-Tung should emulate Chiang Kai-Shek and throw off the Russian yoke when he feels strong enough to do so? It would be in keeping with Chinese characteristics of pride, independence, and age-old isolationism. Moreover, such an event would not be very different from the example set by Japan when, with western aid, that country achieved a degree of industrial power.

Undoubtedly a break between Russia and China is a distinct possibility. It is not likely to come, however, whilst the present American attitude towards China persists. Time and the voice of reason may see a change of this attitude in the future. If it does not, and there is no major war in the interim, the balance of world power will swing in favour of Communism. No doubt, in 25 years, further scientific progress will be made in the west, but the gap between east and west will be narrower. The influence of sheer numbers on productive capacity is likely to offset any narrow advantage in technical ability. All this may be overshadowed by the wholesale destructive power of thermo-nuclear weapons in the possession of both sides. For the nations of the world to formulate long-term policies on the basis of the use of these weapons, however, cannot really be contemplated. The risk of extinction of the human race, or at least of modern civilization, is too great. Whilst the west has no alternative but to develop such weapons as instruments for the preservation of peace, policies which do not involve their use must be the aim. In the interests of survival, the west's policy, however distasteful it may seem today, must eventually be to separate China and Russia.

If the west can succeed in breaking the Russo-Chinese alliance, or the break should occur without western prompting, two courses are open to China. Either she throws in her lot with the west or she follows an independent path. The first of these

two possibilities is the more likely, since China will probably still need some economic assistance in addition to trade relations. In this case, the balance of power will undoubtedly be in favour of the west. In China, the west would have an ally who can outnumber the Russian hordes, thus adding decisively to western technical superiority. On the other hand, should China choose independence, she would hold the balance of power in the world. In such an event, Japan would be the natural trading, and possibly military, partner for China. Looking further into the future, an alliance between China and Japan might well recreate the bogey of the yellow peril. It is an interesting speculation that this long apprehended danger might eventually lead to a *rapprochement* between Russia and the western Powers.

Whatever the final outcome, it is clear that China is on the road to industrialization which nothing short of a third world war in the fairly near future will stop. It is also clear that, once industrialized, China is destined to play a major part in world affairs for many generations to come.

THE INTERNATIONAL SITUATION[1]

By A. K. Chesterton, M.C.

GENEVA PROBLEMS

"The Thaw"

As this commentary is being written on the day that the heads of Governments meet in conference at Geneva, there could scarcely be a time more dangerous for prediction: no writer relishes the thought that before his words appear in print they may be mocked by events. The risk has to be taken, because it would be absurd to discuss the international situation without examining the factors which confront the arbiters of the modern world as they meet at top level for the first time since Potsdam, exactly ten years ago. There has already been much speculation about the various national attitudes likely to be adopted at Geneva, and as the heads of Governments have all seen fit to make preliminary announcements, it is perhaps not being too bold to reach one dogmatic conclusion. It is that on the cardinal issue of Germany, which looms largest in the East-West dispute, no agreement is possible either now or in the foreseeable future.

It is true that the Soviet Union, after refusing for nearly ten years to negotiate a treaty with Austria, suddenly reversed its policy and negotiated a settlement in as many weeks. It is also true that, in general, Soviet frowns have changed to Soviet smiles in the process of what its chief propagandist, Ilya Ehrenburg, has called "The Thaw." Some British and American critics of affairs, especially those who are habitually a little over-optimistic about Russian intentions, have argued that the warmer and balmier winds blowing from the East betoken a radical change, not alone of Soviet intention, but of the actual regime. One London editor is convinced that this revolution—for revolution it would certainly be—required no more for its accomplishment than the death of Beria. Writing from Moscow, he tells his readers that "with his (Beria's) disappearance an evil system was swept away" and adds: "It is this that makes me optimistic here. The system, not only the man, has been ended." That hypothesis would seem a little hazardous!

Soviet Technique

The execution of chiefs of the secret police, so far from being a new departure, is an old Soviet custom. I cannot call to mind one who died in his bed. Whenever Stalin sought to woo the people after a bout of 'purges' he would appear to take their side against the tyranny of officials who oppressed them by 'purging' the 'purgers.' Nor is Soviet amiability an invention of Marshal Bulganin. There was never an inter-Allied conference during the war when the disarming smile did not alternate with toughness as an intrinsic part of the Soviet technique. In the 'twenties and 'thirties, moreover, Moscow's foreign policy was based on much the same principle. After international tensions had been made to yield a profit for the Soviet Union, Stalin would seek further profits from their relaxation, and vice versa. The present Russian Government continues to use these alternations for its own benefit, and the fact that it seems to have made a record 'thaw' the order of the day does not mean, as the optimists suppose, that the 'Marxist dialectic' and the 'Leninist-Stalinist' line are things of the past.

To what extent, if any, the Russians are prepared to compromise will be shown at Geneva during the discussions on Germany. The Soviet Union from the first has

[1] As deduced from reports up to 18th July.

tried to present itself to the Germans as the champion of German unity, with the western Powers as the wicked conspirators determined to keep the country rent asunder. Few Germans are likely to have been deceived. It is possible, though far from certain, that the Russians would agree to a German solution on the same lines as the Austrian solution—demanding as the price nothing more than Germany's disarmed neutrality. The reason why there is no assurance of a Russian willingness to negotiate on those terms is that a unified Germany, with its government based on free elections, although under treaty obligation not to adhere militarily to the West, would undoubtedly in every spiritual sense reject the East. This would mean the complete loss of Soviet influence throughout what is now the Russian occupation zone.

Both Sides Adamant

The question in any event will not arise, because the West cannot be expected to agree to Germany's ' unarmed neutrality.' Several years—and countless French Cabinet crises—have been taken up with the search for a formula which would enable the western nations to agree to the rearmament of Western Germany. That formula has now been found, the German cadres have been formed, and American plans for the equipment of the 12 German divisions are far advanced. It is not to be expected that all this patient work, with its promise of powerful reinforcement for the West—the side deficient in manpower—will be cast away and a military vacuum created in the heart of Europe. Nature abhors a military vacuum just as much as any other kind.

There has been in the Eastern Zone as much effort, and perhaps considerably more, to consolidate the influence of the Occupying Power. The Eastern German forces, for the most part camouflaged as armed police—there are even police panzer divisions—may not be as fully indoctrinated, and therefore as reliable, as the Russians imagine, but as they are kept in being they obviously represent value to the Russian mind, and in the world of power politics values are not lightly thrown overboard. In all these circumstances the Geneva discussions on Germany can scarcely fail to produce a fiasco. The intractable problem of German unity seems likely to wait for its solution until the present power complex in Europe is liquidated, not by talk, but by some kind of cataclysm, internal or external.

Disarmament to ' Deterrence ' Level

The two other items on the Geneva agenda are ' European Security ' and ' Disarmament.' As the first is closely bound up with the German question, no good purpose can be served by discussing it outside that context. Disarmament, however, is another matter. As Russian policy has ' a new look,' so indeed has American policy. After more than ten years spent in stock-piling first the A-bomb and then the H-bomb, the United States suddenly set up a sort of Ministry of Disarmament and appointed Mr. Harold Stassen, who had been doing important work as head of the Foreign Operations Administration, to take charge of it. Some idea of the task to which Mr. Stassen is addressing himself has been revealed in general terms, by President Eisenhower and, in more particular terms, by the Washington correspondent of the *Sunday Times* in what would appear to be a most significant article. According to this article, full atomic energy inspection " in the conditions of the modern world " is not now a practical proposition, and there cannot " at present " be international enforcement of disarmament. That has been a constant theme of the writer of these Notes.

What is now contemplated is the reaching of an agreement with the Russians for the abolition of nuclear weapons over and above those needed to furnish what has been called, not very happily, " minimum deterrence." The term is tautologous. Nations possessing the power of deterrence would be able to say to another nation, or combination of nations: " If you embark upon a war, we have the means of bringing your war-making apparatus to a full stop, thus ensuring your defeat." Such means either is a deterrent or it is not a deterrent. To speak quantitatively of deterrence is thus to confuse the issue. Yet the Washington correspondent of the *Sunday Times* insists that Mr. Stassen and his experts are engaged in working out what constitutes " minimum deterrence " in the belief that an eventual agreement may be reached with Moscow for a standstill agreement and the destruction of stocks in excess of the ' deterrent ' minimum. This, it is believed, will be a big step towards world peace. The reasoning on which the belief is based is not at all clear.

Towards a Monopoly

The United States, it may be presumed, already possesses the power of deterrence. Whether or not the Soviet Union possesses such power cannot be known for certain, but we may be sure that it will create as many weapons as it considers to be necessary, irrespective of the terms of any treaty. Thus no standstill agreement will affect the fundamental position of either the United States or the U.S.S.R. Why, then, do the Americans, who certainly are not fools, attach such importance to the proposal that they set up the equivalent of a State Ministry to work out its details?

I can think of only one explanation. The idea may well be to fix a power of deterrence which would apply to the non-Communist West as a whole and to the Communist East as a whole, but which in effect would be a nuclear weapons level already attained by the United States and either attained, or to be attained, by the Soviet Union. In other words, the standstill agreement, if negotiated in the fairly near future, would prevent any other nation from possessing its own power of deterrence. As we have yet to test our own first H-bomb, for example, it is reasonable to assume that we do not as yet exercise such power, and a standstill agreement would prevent our attaining it. Thus there could never again be a *Pax Britannica*. Instead, our means of protection would remain in American hands. It will be seen that nothing less than our national sovereignty—and that of all nations other than the two ' high contracting parties '—would be at stake.

The British Position

President Eisenhower, on the eve of leaving for Geneva, expressed the view that he thought progress might be made on disarmament. There is reason to suppose, therefore, that preliminary surveys of the ground revealed little prospect of agreement on the other two items on the agenda and that disarmament will be the dominant issue. Nevertheless, care is being taken not to submit what can conveniently be called the ' Stassen Plan ' to a final decision at this conference. Semi-official statements emphasize that the details will not be worked out in time, and that the most to be attempted will be the ' sounding out ' of the Russians. As the ' sounding out ' is likely to have been done weeks ago, it is possible that one or both of the other Governments concerned may have scented the need for caution and requires to be ' brought into line.'

The views of the British Government on the disarmament proposals would be of much interest. As British diplomacy is more reticent than that of our Allies we

have had to be content with generalities which do not mean very much and which are not intended to mean very much. It is certain, of course, that London will not fail to recognize the importance of what has been proposed. The attitude adopted towards it will depend upon how far, if at all, the famous George Washington dictum about the unwisdom of expecting real favours between nations is still held to be valid.

ASIA

The Status Quo in Formosa

Asian problems have no place on the Geneva agenda. That is just as well. The German impasse will sufficiently tax the patience of the delegates without their having at the same time to give their minds to the Formosan impasse. Although excitement in—and about—the Formosan Strait has temporarily died down, neither side has relinquished its basic attitude. It would be true to say, in present circumstances, that neither side can relinquish its attitude. Congressional opinion in the United States was uneasy at the withdrawal from Quemoy and Matsu, and has since hardened over the necessity of retreating no further, so that the defence of Formosa and the Pescadores has come to be regarded as the supreme test of Governmental sincerity in the drive to contain Communism. As such it is not, and in the foreseeable future can never be, a Party question.

Mao Tse-tung and Chou En-lai, on the other hand, are just as fully committed to the acquisition of Formosa as the Americans are committed to the task of denying it to them. ' Face ' is so deeply involved in the matter that the Peking Government not only cannot surrender its claim, but will be under an obligation at least to continue to make warlike noises and gestures in the area. Difficult though it is to imagine that Formosa would be considered worth the hazards of thermo-nuclear warfare, Communist demonstrations in the vicinity could have unpredictable results were they to lead the United States Congress to suppose that they indicated an imminent landing on the island. The strength of Red China's feelings may be gauged from the fact that the joint communiqué drawn up in Moscow by Marshal Bulganin and Mr. Nehru demanded the satisfaction of " the legitimate rights of the Chinese People's Republic in regard to Formosa." No amount of talking between East and West can solve this dispute, which will be settled only after the whole world pattern is subjected to its next violent upheaval.

Viet-Nam

It cannot with honesty be said that this year's conference at Geneva can draw much encouragement from a contemplation of last year's conference at Geneva. The Southern Viet-nam Prime Minister, it is true, is rather more in control of his country than he was when last quarter's JOURNAL appeared, but he still has serious short-term troubles with which to cope, while his middle- and long-term difficulties are appalling. The Hoa Hoa revolt is still far from being suppressed. Heavy but inconclusive fighting has taken place north of Cantho, where an attempt to surround Ba Cut's forces failed. There have been extensive operations in the region of the Seven Mountains in Western Cochin China, while the cleaning-up of the Cao Lanh sector, south of Saigon, drags on from month to month. The belief that M. Diem, confronted with a military task as seemingly endless as that facing the Burmese Government, can provide any kind of bastion against the expansion of Communism would appear to be a little optimistic.

However, M. Diem's present military headache is as nothing compared to the political headache which will be his at next remove, when he will be required, in fulfilment of the Geneva pact, to concert with the leader of North Viet-nam measures for the holding of ' free elections ' throughout the country. The requirement is so onerous that it will not be surprising if he allows it to go by default. Meanwhile, Ho Chi-minh has been to Peking to enlist Red China's aid in mitigating the near-famine conditions prevailing in his territory and is at present in Moscow, where his hosts may be instructing him in the conduct of ' free elections.' As though to make sure of the final debacle, the Southern Viet-nam Government has reached an agreement with Paris for the complete evacuation of the French forces.

Laos

The troubles in Viet-nam have their counterpart in Laos. The Geneva agreement provided that the Pathet Lao Communists should withdraw for regrouping into two northern provinces, and that these provinces should nevertheless come under the control of the Laotian Government. No attempt has been made to honour this clause. Instead, the forces of Pathet Lao, originally few in number, have greatly multiplied by means of the compulsory indoctrination of northern Laotians—the classical Communist technique in such situations—and attempts by the Government to move into the provinces have met with armed resistance, culminating in fierce fighting.

Efforts have been made to ascribe responsibility for this flagrant breach of the truce to Pathet Lao alone, so as to put Viet Minh ' in the clear.' The facts do not support such a view. Viet Minh cadres form the hard core of the Pathet Lao forces, which also receive their military supplies from across the border. Thus there is no doubt that the whole Communist world is involved in a clear defiance of the obligations to which it gave its solemn assent at Geneva last year. Delegates to the Geneva conference this year may perhaps be entitled to entertain doubts as to how far the Communist leaders are prepared to honour any agreement which conflicts with their own purposes.

Aden Protectorate

When a battalion of Seaforth Highlanders and a squadron of the Life Guards were hastily summoned from Suez to move forward with Protectorate levies to relieve the besieged post of Robaat, agency messages referred to the operation as a salutary ' showing of the flag.' This comforting phrase served to conceal the fact that Robaat, after being relieved, was evacuated with all speed—the third such fort to be abandoned during the recent outbreak of tribal turbulence. In other words, a large area of the Western Aden Protectorate seems at present to be untenable.

To keep the peace in such border regions, as all who have had experience of them will attest, there has to be a constant adroit balancing of local political factors by the civil arm. Recourse must sometimes be had to military sanctions, but to rely upon garrisoning for the maintenance of law and order would obviously be hopelessly uneconomic. The members of the Aden administration now face the additional disadvantage of having to contend with encouragement of the insurrection from outside the Protectorate—notably from the Yemen and Egypt, and perhaps from other interested sources as well. A certain amount of turbulence is endemic in these frontier regions, but the scale of the present insurrection, and the availability of plentiful cash to induce the levies to desert, suggests that there may be oil ' in them thar hills.' If this is to take a cynical view of the situation, Britain's post-war experiences might seem to justify a certain amount of cynicism.

EASTERN MEDITERRANEAN

Cyprus

The British Government has issued invitations to parties interested in the Cyprus dispute to attend a meeting in London in August. Archbishop Makarios, leader of the Enosis movement, responded with a flat assertion that the talks are doomed to failure. The Enosis leadership is anxious, not for a give-and-take conference in London which might lead to a *modus vivendi*, but for the use of the United Nations forum in New York. It is perhaps permissible to suggest that if the United Nations is to unscramble all the eggs that have been scrambled as a result of wars and conquests, it might as well discover the nearest living approximation to Neanderthal Man and hand him the Earth.

Meanwhile, British protests to Athens about hostile broadcasts from Greece to Cyprus have led to only a slight diminution in the violence of the language employed to incite Cypriots to spill British blood. As Greece is kept going by American military and other economic aid, a word from Washington might work wonders.

NORTH AFRICA

After many debates in the French Chamber, a large majority was found for a measure which will set Tunis firmly on the path to ' independence.' Safeguards for the settlers were written into the Act, but how little effective they are likely to prove is suggested by the fierce opposition of the settlers themselves. Twenty years hence, how many will still be there ?

The next step, as M. Mendes-France has indicated, is for the French similarly to ' disengage ' in Algeria and Morocco. All these happenings are represented as ' progressive ' and conducive to stability and good order in the world. Some Frenchmen, at least, are quite sure that such measures are retrograde, and that sooner or later, perhaps after much violence and misery, policy trends will have to be reversed if chaos is not to reign over large parts of the Earth.

CORRESPONDENCE

(Correspondence is invited on subjects which have been dealt with in the JOURNAL, *or which are of general interest to the Services. Correspondents are requested to put their views as concisely as possible, but publication of letters will be dependent on the space available in each number of the* JOURNAL.—EDITOR.)

FIRST USE OF AIR OBSERVATION OF ARTILLERY FIRE

To the Editor of the R.U.S.I. Journal.

SIR,—Turning over old papers, I found a letter from the late Lieut.-General Sir George MacMunn (R.A.) dated 1950, which I had overlooked. He wrote that in the early part of 1900 (April) he was, as captain, with a small force consisting of two 15-pdrs. of the 37th Battery, some Munster Fusiliers and oddments, and the 3rd Balloon Section, R.E., under Temporary Major R. B. D. Blakeney with (Colonel) A. H. Bell as his subaltern at Fourteen Streams on the Vaal, watching the line of the river until the troops for the relief of Mafeking were ready. On the other side of the Vaal, about 7,000 yards away hidden by *kopjes*, was a large Boer lager, and 12-pdr. Krupp guns from it occasionally shelled the British camp. It was decided to counter-annoy the enemy, and a 6-in. gun on a railway truck was sent from Kimberley, a siding being laid to receive it.

Up in a balloon went MacMunn to observe the fire: "Great fun it was. You never saw such an exodus of every sort of vehicle hastily inspanned." Colonel Bell confirms the story, adding that the idea of bringing up the 6-in. gun came from Blakeney; and the same story is told in *The History of Early British Aeronautics* by Brigadier P. W. L. Broke-Smith (himself one of the early 'balloonatics') in the *R.E. Journal* of March, June, and September, 1952. That history, however, states, without giving the names of the observers, that in the previous November at the siege of Ladysmith "artillery fire, including the fire of the successful naval Long Toms, was directed" by the 2nd Balloon Section, R.E., commanded by the late Major-General Sir Gerald Heath who, it is believed, was the observer.

Does anyone know of an earlier instance? In Cuba in 1898, that is a year earlier, the Americans sent up a balloon for observation purposes, but as it drew the fire of the whole Spanish army—on the troops below—it was soon pulled down.

J. E. EDMONDS,
Brigadier-General.

4th May, 1955.

ATOMIC AND HYDROGEN BOMBS

SIR,—As Brigadier Williams mentions my name in your May[1] number as being the author of inaccurate statements which appeared last November, an *apologia* appears to be called for.

Of course my atomic knowledge is 'sketchy.' In company with most of your readers I am not a physicist! My remarks were based on an article which, as far as I can remember, appeared in the American periodical *Time*, which is usually very well informed.

It is over nine years since the American physicist Dr. Smyth wrote: "It is conceivable that totally different methods may be discovered for converting matter into energy since it is to be remembered that the energy released in uranium fission corresponds to the utilization of only about one-tenth of one per cent. of its mass. Should a scheme be devised for converting to energy even as much as a few per cent. of the matter of some common material, civilization would have the means to commit suicide at will."

A good deal of water has flowed under the bridges since that was written!

My letter was only part of a correspondence which began last August and which was concerned not so much with types of weapons, but with certain tactical aspects of atomic warfare.

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[1] Page 290.

For too long this subject, perhaps on account of security, has been shrouded in mystery. It is to the credit of the R.U.S.I. JOURNAL that it has now been ventilated.

But, with all respect, Brigadier Williams's criticism has been more destructive than helpful. His last three paragraphs are entirely irrelevant for we are not concerned with "world economics," or "a world without war," or "Utopia." It is a soldier's job to deal with war potential and leave other matters to the politicians.

I therefore make this final categorical statement. There will be, in any future war, different types of atomic bombs adapted for different purposes.

CECIL F. MILSOM,
Major (Retd.).

17th June, 1955.

FIRST IN THE FIELD

SIR,—If Major Teichman's Civil War worthies[2] are to be accepted as belonging to the ranks of genuine war correspondents, then what about the contemporary chroniclers of the Hundred Years' War?

Do Knighton, Rymer, the Chandos Herald, Jean le Bel, Northburgh, and Winkley—to name no more—fulfil the necessary qualifications according to Teichman?

For that matter, both King Edward and the Black Prince wrote despatches for home consumption to which any war correspondent would have been proud to put his signature.

Subsequently, there were the intermittent war despatches published in the *Swedish Intelligencer*. If the *daily* paper be ruled out as the start-point, we shall find ourselves in very deep waters indeed.

REGINALD HARGREAVES,
Major (Retd.).

18th June, 1955.

THE LURE OF THE RED COAT

SIR,—The last sentence on page 274 of the May issue states "There is no record of any woman or child being embarked from Corunna, and it seems that not one survived that terrible journey."

It is a long time since I read it, and I cannot lay my hands on a copy at the moment, but I do recollect reading in *Fights for the Flag* (Fitchett) a quotation from the *Recollections of Rifleman Harris* wherein he describes a soldier's wife (I think a Highlander) falling out to have her baby. He said he never expected to see either again, but that 24 hours later they caught up, the woman carrying the baby. And he adds that he saw the child, a strong healthy boy, some years afterwards in England.

As I said, I have no means of verifying this at the moment, but I shall be surprised if my recollection is much out.

C. F. C. LETTS,
Major.

18th June, 1955.

MAX HORTON AND THE WESTERN APPROACHES

SIR,—I should like to be the first to agree with your correspondent[3] in the May number that the book *Max Horton and the Western Approaches* is not a complete history of the Battle of the Atlantic during the period of Admiral Horton's command. Indeed, it would have been impossible to compress such a work into his biography without upsetting the balance of the book. Errors of omission are therefore inevitable, and had space permitted, I would have liked to say more about the achievements of other distinguished flag officers and air marshals who contributed to the defeat of the U-boats.

[2] See pages 280 and 291.

[3] See JOURNAL for May, 1955, p. 292.

The services of Admiral Murray, in particular, and the Canadian system of command are described in the *Official History of the Naval Service of Canada, Vol. II*, which by the same token, does not mention Admiral Horton. No disparagement of the responsibilities of the Commander-in-Chief Canadian North Western Atlantic is inferred on page 155 of my book by the use of the term ' Supreme Commander.' It is intended to mean a flag officer responsible for the direction of anti-U-boat operations in the North Atlantic as a whole. My choice of expression was influenced at the time of writing by the controversy going on in the House of Commons and the Press as to whether the Supreme Commander in the North Atlantic was to be British or American. As stated elsewhere in the book, Admiral Horton proposed officially that his powers should be analogous to those of Admiral Doenitz. Although this was never approved by the Government, Horton exercised these powers by general assent, so I do not think it is incorrect to say " There was no question of any other supreme commander while Horton was at Derby House." On the other hand, if the paragraph quoted by your correspondent, albeit out of context, has given a wrong impression, then it is not a fine piece of any class of writing, and his criticism is just.

As the Canadian training scheme and the night escort teacher are fully described in the Canadian History, there would seem to be no need to mention them in a book dealing mainly with Max Horton and the Western Approaches. The ports mentioned on page 172 of the latter include St. John's, Newfoundland, and cover a wide field, so I can see no reason for inferring they were the only places where training was carried out.

I cannot find the several inaccuracies which your correspondent says occur on page 157, nor can I see anything misleading in the ' cowboy ' analogy. Captain Prentice, as I have said, gave a measure of security to his convoys by keeping the U-boats at a distance, but it was not until early 1943 that sufficient highly trained sea and air forces became available to hunt them to exhaustion and/or destroy them on the surface, thus preventing them from overtaking slow convoys in the dark hours.

" Keep 'em well stirred up " would seem to be quite an appropriate metaphor in the sense that you stir something up when you want to put down what is on top and bring up what is underneath, according to taste. I admit, however, that I have no evidence that Captain Prentice ever used these words, which may be one of the inaccuracies.

I was very glad to have the opportunity of mentioning him as one of the pioneers of offensive tactics against U-boats, especially as he had been brought up on a cattle ranch which, like the hunting field, would tend to develop courage, initiative, and resource. But it would be silly to suppose that he could become an escort commander without previous naval training, and since his rank at the time is given in the index, his professional qualifications should be obvious.

W. S. CHALMERS,
Rear-Admiral.

28th June, 1955.

SIR,—It was, I suppose, almost inevitable that an article by a naval officer[4] commenting on Rear-Admiral Chalmers's very interesting book *Max Horton and the Western Approaches* should include some criticisms of the Royal Air Force and the Coastal Command system. But do let us try to be a little less slap-dash about our facts.

For instance, Rear-Admiral Murray states that the 14,000 hours flying per month achieved by " the ex-R.N.A.S." in the last year of the Kaiser's war was not reached by Coastal Command until the middle of 1943. As a matter of fact Coastal Command first flew over 14,000 hours in June, 1940, though the average dropped after that critical month. By July, 1942, however, Coastal Command was flying 14,000 hours a month on anti-submarine operations alone, and if all operational flying is included, that average was passed three months earlier.

[4] See page 280.

That, however, is a comparatively minor detail, though enough to make other statements of 'fact' in the article somewhat suspect. A more serious misstatement is as follows:—"a most suitable aircraft, the Liberator, was in production in the U.S.A. and available to the R.A.F. One squadron of Liberators was given to Coastal Command and converted to use anti-U-boat weapons as early as 1941, but again other priorities inside the R.A.F., over which the Admiralty had little influence, made it impossible for Coastal Command to obtain these essential V.L.R. aircraft in the numbers necessary for the Battle of the Atlantic, until March, 1943." This is an excellent example of the dangers of people without specialized knowledge commenting on rather complicated subjects without carefully checking their references.

Let us have a look at the true facts. The first V.L.R. aircraft was the old Mark I Liberator, with a range of 2,300 miles. No aircraft of British design had anything like this range. No. 120 Squadron (which subsequently became our top-scoring squadron in Coastal, with 16 U-boats killed, 3 more shared with the Navy and 16 more damaged) was set up in June, 1941, with an establishment of nine Mark I Liberators. The first did not arrive till August and by the end of the year there were still only seven—one having been crashed and replaced. The production of Mark I Liberators in the U.S. then ceased, but in the meantime we had succeeded in getting a few Mark II, which were *not* V.L.R. aircraft (their range was nearly 600 miles less than the Mark I), and at the end of 1941, No. 120 Squadron had three of these.

Then the United States came into the war and the supply of Liberators nearly dried up. No. 120 Squadron was in danger of being grounded altogether—actually it only flew 41 hours in March, 1942. To prevent that happening we secured American agreement to loan to the squadron in April, 1942, some of the Mark II Liberators which had been allocated to the R.A.F. on the explicit understanding that they were to form the basis of a heavy bomber force in the Middle East (by this time we were not always masters in our own house in respect of the use of U.S. lend-lease aircraft). They were modified in this Country to give them a bit more range, but again let me repeat they were *not* V.L.R. aircraft.

The next thing was that the Mark II went out of production and the Mark IIIA took its place. Modified in this Country to qualify for the V.L.R. class, it still only had 2,000 miles range compared with the 2,300 of the old Mark I—but that was still more than anything we were producing ourselves. Thirty-two of these were delivered to us by the end of September, after which the supply fell away to a trickle—we only got four in November and seven in December, 1942. There was no question of "other priorities inside the R.A.F."; as many as the Americans let us have went straight into Coastal Command via the modification centre at Prestwick.

If Rear-Admiral Murray had inquired a bit deeper he would have found that the story of V.L.R. aircraft for Coastal Command was a ceaseless struggle to extract this type from the U.S. authorities—a struggle which was carried at times to Prime Minister and President level. As I said about this same subject in an article in this JOURNAL for August, 1953, these things are not always as easy as they may appear—and evidently did appear to Rear-Admiral Murray. It is perhaps understandable that the U.S. Army Air Force should have been a bit reluctant to hand over substantial numbers of their all-too-few heavy bombers to the R.A.F. for the maritime role; but the U.S. Navy were more difficult in this respect than the Army. Rear-Admiral Murray may not know that the re-equipment of the only V.L.R. Liberator squadron in the R.C.A.F. in the Spring in 1943 was effected solely by the surrender of some of the small R.A.F. allocation of this type, at a time when my Liberator strength in Coastal Command was 34. At this same time the U.S. Navy had already taken delivery of 112 out of their allocation of 400 Liberators, of which over 70 were operational—all in the Pacific, where the U-boat threat was virtually non-existent.

Rear-Admiral Murray goes on to say " By that time (March, 1943) the Navy had taken its own steps to provide air cover over ' the gap ' by means of escort carriers and mercantile aircraft carriers, both types operating planes of the Fleet Air Arm. Provision of aircraft from these sources enabled Admiral Horton to take the offensive in ' the gap,' a course of action not available to his predecessors."

This is really a very odd version of history. The actual facts are these. It is always fashionable to criticize the R.A.F. for their delay in producing suitable aircraft for the war at sea. But it was three and a half years after the outbreak of war before the first aircraft carrier appeared in the gap—two escort carriers, one British and one American, in March, 1943. Neither made contact with a U-boat in that month. In the three months March to May two British carriers (*Archer* and *Biter*) and one American (*Bogue*) sank two U-boats and shared two more with the surface escorts. During those same three months, shore-based aircraft (almost all of Coastal Command) covering the North Atlantic convoys sank 14 U-boats and shared three more with the surface craft. As for the mercantile aircraft carriers, the first one did not put to sea with a convoy till June, 1943, and the second not till August. No " Macship " ever sank a U-boat, and I doubt if Doenitz or his captains ever so much as suspected their existence.

I yielded to no one in my admiration and liking for Max Horton, whom I knew 25 years before we fought the Battle of the Atlantic together. But we do no service to his memory by writing fiction about him and calling it history.

J. C. Slessor,
8th July, 1955. *Marshal of the Royal Air Force.*

THE CHINDIT OPERATIONS OF 1944

Sir,—It was disappointing to see in Lieut.-Colonel Mead's article on the 1944 Wingate Expedition,[5] that once more this great campaign has been treated almost entirely from our own point of view—in terms of our movements on the ground, enemy attacks repelled, and comparative casualties. The right approach is surely to consider the effect which General Wingate's action had upon the enemy; this was catastrophic and bore little relation to the Chindit plan as given by Lieut.-Colonel Mead.

The Burma Campaign of 1944 must be considered in two phases, the defeat of the Japanese offensive and the advance into Burma. The Japanese launched themselves across the Chindwin on 8th March, 1944, in three divisions, one based on Kalewa, one on Pinlebu-Wuntho, and one on Indaw. They carried with them supplies and ammunition for about three weeks, counting thereafter to a great extent on captured British stocks, but expecting also replenishment and reinforcements from their divisional base areas. The landing of the Chindits on 5th–7th March had the following effects :—

(*a*) It flung the whole Japanese Command into uncertainty as its extent and exact position was not known for some time.

(*b*) It drew off almost the whole of the air effort intended to support the Imphal offensive and absorbed all the ground forces earmarked as reserves.

(*c*) It destroyed the two divisional bases at Wuntho-Pinlebu and Indaw. Thus the two northerly Japanese divisions received no supplies, ammunition, or reinforcement whatever, and as " Churchill rations " did not materialize they eventually starved.

(*d*) It delayed until the end of April the move of the Japanese C.-in-C., Mutaguchi, and his headquarters from Maymyo to the battlefront. By the time he arrived things had already gone gravely wrong and he found it necessary to replace all three divisional commanders.

We have perhaps forgotten that the Japanese offensive against Imphal was a serious matter and that it was for a time touch and go. Perhaps it wasn't and the whole of 14th Army laboured under a delusion. But if it was, then these Chindit effects must

[5] See Journal for May, 1955, p. 251.

have been important, if not decisive, in the Japanese defeat. The Japanese certainly thought so. You cannot fight without food and ammunition and if you are brought to this condition, then the man who brings you to it must have some credit. How much of it all Wingate foresaw is another matter. He was a man not without foresight.

C. H. M. TOYE,
Major, R.A.

30*th June*, 1955.

HELICOPTERS FOR THE ARMY

SIR,—May I have space to reply to Captain Parfect, R.E. ?[6]

I agree that the Army's requirement will be for at least two types of helicopter—perhaps more. But I still disagree regarding the type of ' transport ' machine needed.

This point is fundamental. Either we work towards a fleet of mechanically complicated ' five tonners ' (such as Captain Parfect visualizes) or towards a much larger number of smaller load-carriers of simpler design. If the first alternative is adopted, it is quite possible, though by no means inevitable, that the ' five tonners ' produced may have to be as complicated in maintenance and operation as a Hastings of today. This might mean that each machine will need a crew of three very highly trained specialists, as he suggests.

But, even if it does, what matter ? Cannot the Army have its own highly trained specialists to do an army job without being accused of being " in competition with " Transport Command, R.A.F. ? After all, both Army and R.A.F. have their own wireless experts, machine-gunners, and many other types of highly trained specialists without any question of competition coming into the matter at all.

Actually, however, in this atomic age the one hope of freeing armies from dependence upon excessively vulnerable supply lines will depend on our aiming at the *second* alternative rather than the first—that is to say reliance upon large numbers of smaller, simpler, and more expendable transport helicopters rather than upon a few heavyweights that we can ill afford to lose.

I visualize this future supply operation on the analogy of the naval convoys to North Russia during the last war. Heavy helicopter losses will at times be inevitable. It may be essential to run the stuff through *no matter how adverse the air situation may be.* A supply service based upon numerous small and ' expendable ' machines, manned by not too ' precious ' experts, could do this whenever the military commander deemed such a sacrifice essential provided that he, the military commander, was in full operational command of his own supply lines. It will be much more difficult to accept heavy losses if the freighters are few in numbers, complicated in design, and manned by specialists who are hard to replace. It will be even more difficult to persuade some distant A.O.C. that the land battle situation is so vital that he must incur this risk of heavy losses.

It may be said against me that big aircraft are far more efficient and economical as load-carriers than a large number of smaller ones. True—but in war the economical is not always the best. It will be better to have an air supply line that gets the stuff through under adverse fighting conditions than a theoretically economical one which may not function at all at a critical moment.

FATHER WILLIAM

1*st July*, 1955.

FIGHTING FORMATIONS OF THE FUTURE

SIR,—I read Major Jackson's article *Fighting Formations of the Future*[7] with much interest, but he made the common mistake of trying to define an atomic target as so many enemy units—he assumes that " a brigade will seldom provide a tempting target."

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[6] See JOURNAL for May, 1955, p. 293.

[7] See JOURNAL for May, 1955, p. 229.

This conception is quite alien to a gunner, who would never try to define any target as a certain number of men. An enemy platoon on patrol might be engaged with only one field battery, but if it were holding a farmhouse on an objective it might be a medium regiment's target; on the Normandy beaches it might buy a battleship.

I suggest that the amount of H.E. that a gunner will fire at a target is governed by four factors, namely :—

(*a*) Formation commander's plan.

(*b*) Availability of ammunition (and/or guns).

(*c*) Importance of the ground, which the enemy is holding, or over which he is moving.

(*d*) Number and vulnerability of enemy located.

There is no reason why the same factors should not govern the engagement of an atomic target. If a commander particularly wants to capture a hill, and there is an atomic shell available, I believe that it will be fired even if the hill is held by only one battalion.

From a gunner's point of view this leads to two conclusions :—

(*a*) Guns should not be deployed near likely atomic targets, such as communication centres, important tactical features, or obstacle crossing places. (In " Battle Royal " two regiments were ' destroyed ' ; one in a natural defile, and the other in the area of an assault river crossing.)

(*b*) OPs on a tactically important feature are likely to be ' atomized ' if the feature is strongly held. As an OP officer, on an important hill, I would welcome the company of only a few MGs and tanks, with the minimum number of infantry required for their close protection, providing that :—

(i) There was a good obstacle in front, which was covered by fire during daylight and infantry patrols at night.

(ii) There was a mobile reserve available to occupy the hill if the enemy penetrated the obstacle and committed his infantry within the danger zone of an atomic missile burst over the hill.

Infantrymen may say that they must dig in on good tactical ground, covering approaches to vital ground. As a gunner, I would contend that if they do, they will be sitting in a frying pan (allied term for an atomic killing ground).

M. R. W. BURROWS,
Major.

11th July, 1955.

GENERAL SERVICE NOTES

NORTH ATLANTIC TREATY ORGANIZATION

Western Germany becomes a Member

On 9th May, the German Federal Republic formally entered N.A.T.O. as its fifteenth member, when a North Atlantic Council meeting was attended by the Foreign Ministers of all 15 N.A.T.O. countries. The German Federal Republic was represented by Dr. Adenauer.

Subsequently, on the same date, German military representatives, led by Major-General Hans Speidel, made their official entry to S.H.A.P.E., where they were received by General Alfred M. Gruenther, the Supreme Allied Commander, and General Lehr, representing the French Ministry of Defence.

BAYEUX MEMORIAL

On 5th June, H.R.H. the Duke of Gloucester unveiled at Bayeux a Memorial to 1,837 soldiers who fell in the assault upon the Normandy beaches or in the sweep to the Seine, but to whom the fortunes of war denied a known and honoured grave. The Memorial, on which the names of these soldiers are recorded, faces the entrance to Bayeux War Cemetery which contains 4,713 graves. The next-of-kin of all those commemorated, which included some from Canada and Australia, were invited to attend, and representative contingents of the Royal Navy, the Royal Marines, the Royal Air Force, and units and formations of the Army which took part in the Normandy campaign participated in the ceremony. The Guards of Honour were found by the 1st Battalion, The Royal Welch Fusiliers, the 2nd Regiment, Royal Canadian Horse Artillery, and the 2nd Battalion, Infanterie Coloniale.

GREAT BRITAIN

Imperial Defence College

New Commandant

The Ministry of Defence announced on 16th June that Admiral the Hon. Sir Guy H. E. Russell, G.B.E., K.C.B., D.S.O., would succeed Air Chief Marshal Sir Arthur P. M. Sanders, G.C.B., K.B.E., A.D.C., as Commandant of the Imperial Defence College on 1st January, 1956.

Royal Tournament

The Queen, accompanied by the Duke of Edinburgh, was present at a performance of the Royal Tournament at Earls Court on 9th June. This Tournament, in which all three Services were represented, opened on 1st and ended on 18th June.

Civil Defence

Recruitment and Organization

It was reported on 9th May that since the opening of recruitment in November, 1949, 334,819 men and women have joined the Civil Defence Corps in England and Wales. The increase between 31st December, 1954, and 31st March, 1955, was 3,628. The Home Secretary has decided to create a new senior post of Regional Civil Defence Officer in each of the regions of England, and a post of Civil Defence Officer for Wales.

Soldiers', Sailors', and Airmen's Families Association

The fourth Searchlight Tattoo in aid of the Soldiers', Sailors', and Airmen's Families Association took place each evening at the White City Stadium from 4th to 9th July. The salute at the opening performance was taken by General Alfred M. Gruenther, Supreme Allied Commander, Europe, and he was received by a Guard of Honour formed by men of the three United States Services stationed in Britain. The band and pipes of the Arab Legion and a band of the United States Air Force were among those who took part in the display.

DOMINIONS AND COLONIES

CANADA

DEFENCE COLLEGE TOUR.—Thirty-four members of the directing staff and students of the National Defence College, Kingston, the students consisting of senior officers of the three armed Services and officials from various government departments, spent April and May on tour in Europe and Asia. The entire party first visited the United Kingdom and France and then split into two groups; one group visited Western Europe, the other the Middle East and South Asia. Among the countries visited were Western Germany, Greece, India, Italy, Pakistan, and Turkey.

UNIT AND DETACHMENTS ATTEND ATOMIC TEST.—After a long period of intensive training, the Canadian Army's Radiation Detection Unit augmented by detachments from the Royal Canadian Navy and Royal Canadian Air Force travelled to Camp Desert Rock near Las Vegas, Nevada, to participate in an atomic test scheduled to take place on 26th April. This was the first time that men of the Canadian Services had taken part in atomic bomb trials.

NEW RADAR LINE.—On 20th May, it was announced by Mr. Lester Pearson, Canadian Secretary of State for External Affairs, that under an agreement with the United States the U.S. Government would pay the full cost of the construction and operation of the new radar defence line in the Canadian Far North. Canada, on the other hand, would have the right on reasonable notice, in which event she would pay her share, to take over the operation of any or all of the installations after full consultation with the United States. Other conditions included preference for Canadian labour and electronic equipment manufactured in Canada, and a guarantee of Canadian sovereignty in the area covered by the new radar line installations.

AUSTRALIA

FORCES FOR MALAYA.—The Prime Minister, Mr. Menzies, announced in April that Navy, Army, and additional Air Force units would go to Malaya as soon as practicable. Naval forces would include two destroyers or two frigates, an aircraft carrier on an annual visit, and additional ships in an emergency. The Army contribution would be an infantry battalion with supporting arms and with reinforcements in Australia. The R.A.A.F. would contribute a fighter wing of two squadrons, a bomber wing of one squadron, and an airfield construction squadron—in addition to the bomber squadron which has been operating in Malaya for about four years. On 15th June, Mr. Menzies said that the Defence Department and the armed forces were also preparing plans for consideration by the Cabinet to have two divisions ready for any emergency in South-East Asia.

On 27th June, it was reported that the 2nd Battalion, Royal Australian Regiment, would leave Australia for Malaya at the end of September. The Battalion will go to Penang. No. 2 Airfield Construction Squadron, R.A.A.F., would sail in August or September for Butterworth R.A.F. base on the mainland opposite Penang.

NEW ATOMIC TESTING GROUND.—On 4th April, it was announced that the British and Australian Governments had agreed to establish a new atomic testing ground in South Australia, the existing site being no longer suitable because of shortage of water supplies. The first tests in the new area, which would not be atomic explosions, are expected to take place later this year.

NEW ZEALAND

FORCES FOR MALAYA

It was announced by Mr. Holland, the Prime Minister, on 24th March, that New Zealand would despatch two N.Z. frigates to Malaya, with a possible third should the necessity arise; would transfer a fighter squadron from Cyprus to Malaya and, in addition, maintain half a transport squadron and half a maritime reconnaissance squadron; and would raise a Special Air Service unit for service against the terrorists in Malaya.

INDIA

Treaty of Friendship with Egypt

On 6th April, a treaty of friendship between India and Egypt was signed in Cairo by Nawab Ali Yavar Jung Bahadur, the Indian Ambassador, and Dr. Fawzi, the Egyptian Foreign Minister.

ADEN

Military Reinforcements Despatched by Air

It was officially announced on 1st July that military reinforcements consisting of the 1st Battalion, The Seaforth Highlanders, and one squadron of the Life Guards, from the Suez Canal zone, had been flown into Aden as a precautionary measure, several clashes with rebel tribesmen having taken place in the Aden Protectorate. General Sir Charles Keightley, C.-in-C., British Middle East Land Forces, and Air Marshal Sir Claude Pelly, C.-in-C., Middle East Air Force, arrived in Aden by air on 30th June to review the situation.

FOREIGN

AUSTRIA

Treaty Signed

On 15th May, the Austrian State Treaty was signed in Vienna by the Foreign Ministers of the four occupying Powers and by their Ambassadors in Austria: Mr. Macmillan and Sir Geoffrey Wallinger, Britain; M. Pinay and M. Roger Lalouette, France; M. Molotov and M. Ilyichev, Soviet Union; and Mr. Dulles and Mr. Llewellyn R. Thompson, U.S.A. Dr. Figl, the Austrian Foreign Minister, signed on behalf of Austria. Under the terms of the treaty all foreign occupation troops will be out of Austria at the latest by 31st December, 1955; Russia must hand back all Russian-held properties and rights in Austria within two months after the treaty comes into force; any German peace treaty concluded will recognize Austria's independence, and any *anschluss* is prohibited; all Nazi organizations are to be dissolved and service in the Austrian armed forces of former Nazis is forbidden; and Austria is not to experiment with or possess any atomic weapons or other weapons for mass destruction.

When ratified, the treaty will end more than 10 years of Allied occupation, which was preceded by seven years of German occupation, and will re-establish Austria as a sovereign and independent State.

BURMA

Peace Treaty with Japan

The peace treaty between the Union of Burma and Japan, which was signed at Rangoon on 5th November, 1954, came into force on 16th April when instruments of ratification were exchanged in Tokyo.

EASTERN EUROPE

Conference of Ministers

Between 11th–13th May, the Prime Ministers, Foreign Ministers, and Defence Ministers of the eight countries of Eastern Europe—the Soviet Union, Poland, Czechoslovakia, Eastern Germany, Hungary, Rumania, Bulgaria, and Albania—attended a conference at Warsaw which resulted in (*a*) the signing of a 20-year treaty of friendship, co-operation, and mutual assistance, and (*b*) the creation of a unified military command for the armed forces of all those countries except Eastern Germany. Marshal Ivan Koniev of the Soviet Army was appointed Commander-in-Chief of the joint armed forces. An observer from the Chinese People's Republic also attended the conference.

GERMAN FEDERAL REPUBLIC

Attainment of Sovereignty

On 5th May, the London and Paris agreements came into force officially, thereby ending the occupation regime in Western Germany and giving the German Federal Republic full sovereignty and independence.

IRAQ

New Anglo-Iraqi Defence Agreement

On 4th April, the agreement laying down the terms of defence co-operation between Britain and Iraq, and replacing the 1930 Anglo-Iraqi treaty of alliance, was signed in Baghdad by General Nuri es-Said, the Iraqi Prime Minister, and Mr. R. H. Turton, British Joint Under-Secretary for Foreign Affairs. The agreement came into force on 5th April, when Britain's instrument of accession to the Turkish-Iraqi Treaty was deposited at the Iraqi Foreign Ministry.

THE NETHERLANDS

Ratification of Paris Agreements

The Paris agreements were approved by the Upper House of the Netherlands on 28th April (*vide* G.S. Notes in the May, 1955, Journal, page 298).

UNITED STATES

C.-in-C., U.S. and U.N. Forces, Far East.—General Lyman L. Lemnitzer has become Commander-in-Chief of the U.S. and U.N. forces in the Far East in succession to General Maxwell D. Taylor.

Military Aid Agreement with German Federal Republic.—A military aid agreement between the U.S. and the Federal Republic, covering the large volume of military aid which the U.S. will furnish to equip the new armed forces of the Federal Republic, was signed on 30th June by the U.S. Ambassador, Dr. Conant, and Herr von Brentano, the Federal Foreign Minister. The agreement, which does not specify the extent or value of the material and services to be granted, contains an undertaking by the Federal Republic that it " will not use such assistance for any act inconsistent with the strictly defensive character of the North Atlantic Treaty."

Civil Defence Co-ordinating Board.—On 9th April, President Eisenhower ordered the creation of a Civil Defence Co-ordinating Board to co-ordinate civil defence activities of Federal agencies, and nominated Mr. Val Peterson, the Civil Defence Administrator, as its head. The President asked the Secretaries of Defence, Commerce, Treasury, Health, Education and Welfare, the Interior, Agriculture, the Postmaster-General, and the Attorney-General to appoint senior officials to serve on it. The Office of Defence Mobilization, the Federal Power Commission, the Veterans' Administration, the Atomic Energy Commission, and the General Services Administration will also be represented on this board.

YUGOSLAVIA

New Chief of Staff of Armed Forces

It was announced on 3rd May that Lieut.-General Ljubo Vuckovich had been appointed Chief of Staff of the Armed Forces in succession to Colonel-General Dapcevich.

NAVY NOTES

GREAT BRITAIN

H.M. The Queen

The Queen and the Duke of Edinburgh left Rosyth in the Royal yacht *Britannia* on 22nd June for a State visit to Norway. Escort was provided by the *Virago*, of the 6th Frigate Squadron, and the *Urchin* and *Volage*, of the 3rd Training Squadron. Fifty miles off the Norwegian coast the *Urchin* and *Volage* were relieved by two other ships of the 6th Frigate Squadron, the *Undine* and *Urania*, which had been visiting Sweden, and which with the *Virago* proceeded to Oslo and remained with the Royal yacht during the visit. The Queen and the Duke of Edinburgh returned to Dundee on 27th June. When leaving Rosyth, and again in the approaches to Dundee, the escort was augmented by two coastal minesweepers of the R.N.V.R., the *Montrose*, of the Tay Division, and the *Killiecrankie*, of the Forth Division. This was the first occasion on which R.N.V.R.-manned ships had escorted Her Majesty in the *Britannia*.

Queen Elizabeth the Queen Mother attended the dedication of the Chapel of the Royal Naval College, Greenwich, after restoration, on 21st June.

The Duke of Edinburgh paid an official visit to Portland Naval Base on 25th April, arriving by helicopter. He visited the Admiralty Gunnery and Underwater Detection Establishments and lunched in the wardroom of H.M.S. *Osprey*. (See also "Royal Marines").

Aide-de-Camp.—Captain H. G. C. Butler, R.N., has been appointed a Naval Aide-de-Camp to The Queen in place of Captain G. L. Baily, R.N. (28th February, 1955).

Board of Admiralty

The Queen has been pleased by Letters Patent under the Great Seal bearing date the 18th day of April, 1955, to appoint the following to be Commissioners for executing the Office of Lord High Admiral of the United Kingdom :—

The Rt. Hon. James P. L. Thomas.
Admiral the Rt. Hon. Earl Mountbatten of Burma, K.G., P.C., G.C.S.I., G.C.I.E., G.C.V.O., K.C.B., D.S.O.
Admiral the Hon. Sir Guy H. E. Russell, G.B.E., K.C.B., D.S.O.
Vice-Admiral Sir Ralph A. B. Edwards, K.C.B., C.B.E.
Vice-Admiral F. R. Parham, C.B., C.B.E., D.S.O.
Rear-Admiral A. N. C. Bingley, O.B.E.
Vice-Admiral W. W. Davis, C.B., D.S.O.
Vice-Admiral E. G. A. Clifford, C.B., C.B.E.
Commander A. H. P. Noble, D.S.O., D.S.C.
Kenelm S. D. Wingfield Digby, Esq.
Sir John G. Lang, G.C.B.

In the course of a private visit to England, H.M. the King of Sweden, who is an Honorary Admiral in the Royal Navy, and H.M. the Queen of Sweden were entertained to dinner by the Board of Admiralty on 18th May in the Painted Hall of the Royal Naval College, Greenwich.

The First Lord, Mr. J. P. L. Thomas, M.P., opened on 1st June the Exhibition, "The Little Admiral," dealing with Nelson and his time, at the National Maritime Museum, to celebrate the 150th anniversary of the Battle of Trafalgar.

The First Lord, accompanied by his Naval Secretary, Rear-Admiral J. D. Luce, left London on 24th June in H.M.S. *Obdurate* to pay a return call on the Dutch Minister of the Navy at Rotterdam, returning in the *Obdurate* on 27th June.

Admiral Lord Mountbatten, who succeeded Admiral of the Fleet Sir Rhoderick McGrigor as First Sea Lord on 18th April, will visit Canada and the United States in the Autumn of this year to meet the Chief of the Canadian Naval Staff and the Chief of Naval Operations, U.S. Navy. He expects to be in Canada from 24th to 27th October and in the United States from 27th October to 8th November.

Honours and Awards

The following were among the honours conferred by The Queen on the occasion of the official celebration of Her Majesty's Birthday on 9th June :—

G.C.B.—Admiral the Rt. Hon. Earl Mountbatten of Burma, K.G., P.C., G.C.S.I., G.C.I.E., G.C.V.O., K.C.B., D.S.O.

K.C.B.—Vice-Admiral Frederick R. Parham, C.B., C.B.E., D.S.O.; Vice-Admiral Alan K. Scott-Moncrieff, C.B., C.B.E., D.S.O.

C.B.—Rear-Admiral L. A. Boutwood, O.B.E.; Engineer Rear-Admiral J. E. Cooke; Rear-Admiral L. F. Durnford-Slater; Rear-Admiral J. D. N. Ham; Rear-Admiral C. T. Jellicoe, D.S.O., D.S.C.; Rear-Admiral M. L. Power, C.B.E., D.S.O.; Surgeon Rear-Admiral S. G. Rainsford; Rear-Admiral W. H. Selby, D.S.C.; Rear-Admiral E. H. Shattock, O.B.E.; Rear-Admiral G. Willoughby.

K.B.E.—Vice-Admiral Ian M. R. Campbell, C.B., D.S.O.; Vice-Admiral Peter G. L. Cazalet, C.B., D.S.O., D.S.C.

C.M.G.—Lieutenant-Commander J. Jolly, C.B.E., R.D., R.N.R. (Retd.), Director of Marine, Hong Kong.

(See also under " Australia " and " New Zealand ".)

Flag Appointments

Second Sea Lord.—Admiral Sir Charles E. Lambe, K.C.B., C.V.O., to be a Lord Commissioner of the Admiralty, Second Sea Lord and Chief of Naval Personnel, in succession to Admiral the Hon. Sir Guy H. E. Russell, G.B.E., K.C.B., D.S.O., to take effect in October, 1955.

Plymouth.—Admiral Sir C. T. Mark Pizey, K.B.E., C.B., D.S.O., to be Commander-in-Chief, Plymouth, in succession to Admiral Sir Alexander C. G. Madden, K.C.B., C.B.E., to take effect in November, 1955.

Home Fleet.—Vice-Admiral Sir John A. S. Eccles, K.C.B., K.C.V.O., C.B.E., to be Commander-in-Chief, Home Fleet, in succession to Admiral Sir Michael M. Denny, G.C.B., C.B.E., D.S.O., to take effect in December, 1955. At the same time Vice-Admiral Eccles will also succeed Admiral Denny as Commander-in-Chief, Eastern Atlantic Command.

Reserve Fleet.—Vice-Admiral Sir Peter G. L. Cazalet, K.B.E., C.B., D.S.O., D.S.C., to be Flag Officer Commanding Reserve Fleet, in succession to Vice-Admiral J. W. M. Eaton, C.B., D.S.O., D.S.C., to take effect in the second half of September, 1955.

Mediterranean.—Vice-Admiral M. Richmond, C.B., D.S.O., O.B.E., to be Flag Officer (Air) Mediterranean and Flag Officer Second-in-Command, Mediterranean, in succession to Vice-Admiral J. P. L. Reid, C.B., C.V.O., to take effect in August, 1955.

Rear-Admiral B. I. Robertshaw, C.B., C.B.E., to be Chief of Staff to the Commander-in-Chief, Allied Forces, Mediterranean, in succession to Vice-Admiral Sir Peter G. L. Cazalet, K.B.E., C.B., D.S.O., D.S.C. (to serve in the temporary rank of Vice-Admiral), to take effect in July, 1955.

Rear-Admiral D. E. Holland-Martin, D.S.O., D.S.C., to be Flag Officer (Flotillas), Mediterranean, in succession to Rear-Admiral R. D. Watson, C.B.E., to take effect about 12th July, 1955.

HYDROGRAPHER.—Captain Kenneth St. Barbe Collins, O.B.E., D.S C., R.N., to be Hydrographer of the Navy, in succession to Vice-Admiral Sir Archibald Day, K.B.E., C.B., D.S.O., with effect from 13th June, 1955.

ELECTRICAL DEPARTMENT.—The following was announced on 7th July :—Captain K. H. T. Peard, C.B.E., A.D.C., A.M.I.E.E., to be promoted Rear-Admiral and appointed Director of the Naval Electrical Department, in succession to Rear-Admiral Sir C. Philip Clarke, K.B.E., C.B., D.S.O., M.I.E.E., M.Brit.I.R.E., to take effect on 17th August, 1955.

Mr. R. Henderson, O.B.E., has been appointed Director of Stores, Admiralty, vice Mr. G. F. R. Marsh, C.B., to date 18th July, 1955.

RETIREMENTS AND PROMOTIONS

Vice-Admiral Sir Archibald Day, K.B.E., C.B., D.S.O., was placed on the retired list to date 13th June, 1955.

Rear-Admiral R. S. Warne, C.B., O.B.E., was placed on the retired list to date 15th April, 1955.

Rear-Admiral C. D. Howard-Johnston, C.B., D.S.O., D.S.C., was placed on the retired list to date 1st July, 1955.

Rear-Admiral R. F. Elkins, C.B., C.V.O., O.B.E., was promoted to Vice-Admiral to date 13th June, 1955.

Rear-Admiral J. G. C. Given, C.B., C.B.E., of the Engineering Branch, was placed on the retired list to date 28th June, 1955.

Captain J. B. Newsom, of the Engineering Branch, was promoted to Rear-Admiral with effect from 21st June, 1955, and appointed as Rear-Admiral for engineering duties on the staff of the Commander-in-Chief, The Nore, vice Rear-Admiral J. G. C. Given, to date 28th June.

Surgeon Captain E. T. S. Rudd, C.B.E., was promoted to Surgeon Rear-Admiral with effect from 23rd June, 1955, and Medical Officer-in-Charge, R.N. Hospital, Haslar, and for duty on the staff of the Commander-in-Chief, Portsmouth, from 30th June.

Surgeon Rear-Admiral R. W. Mussen, C.B., C.B.E., was placed on the retired list to date 31st March, 1955.

Rear-Admiral A. W. Laybourne, C.B., C.B.E., was placed on the retired list to date 23rd May, 1955.

The following Captains were promoted to Rear-Admiral with seniority as stated :—H. P. Koelle (15th May, 1955) ; J. B. Newsom (21st June, 1955).

HALF-YEARLY LISTS

The following promotions and retirements were announced to date 7th July, 1955 :—

TO BE PROMOTED TO REAR-ADMIRAL IN H.M. FLEET.—Captain (acting Rear-Admiral) Sir St. John R. J. Tyrwhitt, Bart., D.S.O., D.S.C., A.D.C. ; Captain (acting Rear-Admiral) J. E. H. McBeath, D.S.O., D.S.C., A.D.C. ; Captain (Commodore 2nd Class) Sir Charles E. Madden, Bart., C.B., A.D.C. ; Captain R. S. Foster-Brown ; Captain D. E. Holland-Martin, D.S.O., D.S.C.

TO BE PLACED ON THE RETIRED LIST IN THE RANK OF CAPTAIN.—Captain D. G. F. W. Macintyre, D.S.O., D.S.C., A.D.C. ; Captain R. T. White, D.S.O., A.D.C. ; Captain U. H. R. James, C.B.E., A.D.C. ; Captain W. W. R. Bentinck, O.B.E., A.D.C. ; Captain P. H. E. Welby-Everard, D.S.C., A.D.C. ; Captain K. A. Short, D.S.O. ; Captain C. W. Greening, D.S.O., D.S.C. ; Captain M. J. Evans, C.B.E., D.S.C. ; Captain G. M. Sladen, D.S.O., D.S.C. ; Captain R. C. M. Duckworth, C.B.E. ; Captain M. Everard, C.B.E. ; Captain H. C. Browne, C.B.E., D.S.O.

The following promotions were announced to date 30th June, 1955 :—

Commander to Captain.—P. J. Norton, D.S.C. (acting Captain) ; I. L. M. McGeoch, D.S.O., D.S.C. ; D. K. Buchanan-Dunlop, D.S.C. (acting Captain) ; J. W. H. Bennett, D.S.C. ; P. F. Manisty, D.S.C. ; T. W. Best ; H. S. Hayes, D.S.C. ; R. C. P. Wainwright, D.S.C. ; E. J. D. Turner, D.S.O., D.S.C. ; W. D. O'Brien, D.S.C. ; J. J. S. Yorke, D.S.C. ; J. G. Wells, D.S.C. ; P. N. Howes, D.S.C. ; P. J. S. Hardinge, M.B.E. ; M. P. Pollock, M.V.O., D.S.C. ; N. H. Pond ; E. B. Ashmore, D.S.C.

Engineering Branch—Commander to Captain.—B. S. Blanchford ; F. A. Lowe, D.S.C. ; A. E. Wood ; J. S. Shiffner ; D. A. Williams, D.S.C. ; R. H. Tribe, M.B.E.

Electrical Branch—Commander to Captain.—J. G. Watson, B.Sc. ; D. A. Craddock, B.Sc.

Instructor Commander to Instructor Captain.—A. E. Johnston (acting Instructor Captain) ; A. H. Miles, O.B.E.

Surgeon Commander to Surgeon Captain.—J. L. S. Coulter, D.S.C. (acting Surgeon Captain) ; H. E. B. Curjel (acting Surgeon Captain) ; H. L. Cleave, O.B.E.

Surgeon Commander (D) to Surgeon Captain (D).—A. W. Y. Price (acting Surgeon Captain (D)).

Supply and Secretariat Branch—Commander to Captain.—G. H. Nicholls, O.B.E. ; D. Armstrong, O.B.E.

Royal Naval Reserve—Commander, R.N.R., to Captain, R.N.R.—H. E. Sprigge, R.D. *Commander, R.N.R., to Captain, R.N.R. (Supernumerary).*—W. C. Shepherd, R.D.

Royal Naval Volunteer Reserve—Commander, R.N.V.R., to Captain, R.N.V.R.—C. P. C. Noble, D.S.C., V.R.D. *Engineering Branch—Commander, R.N.V.R., to Captain, R.N.V.R.*—C. Taylor. *Commander (Sp), R.N.V.R., to Captain (Sp), R.N.V.R.*—A. R. Glen, D.S.C.

Exercises and Cruises

Home Fleet.—The main units of the Home Fleet assembled at Portland early in May for the Summer training and exercise programme, which continued until the end of July. Flying his flag in the *Apollo*, the Commander-in-Chief, Admiral Sir Michael Denny, left Invergordon to visit Molde, Norway, early in June. He transferred his flag to H.M.S. *Tyne* when she visited Stockholm from 14th to 21st June in company with the *Bulwark*, *Apollo*, *Undine*, *Urania*, and *Artemis*. He then returned to the *Apollo* for a visit to Helsinki with the *Amphion* between 21st and 28th June, and again transferred his flag to the *Tyne* on 30th June during a visit to Gothenburg lasting to 4th July. The Flag Officer, Training Squadron, Rear-Admiral H. W. Biggs, in the aircraft carrier *Theseus*, visited Bergen at the end of June ; and at the same time the aircraft carrier *Ocean* visited Hamburg. In addition, Home Fleet ships showed the flag in Kristiansand South, Helsingborg, Oslo, Tromso, Reykjavik, Harstad, Narvik, Ramsund, Vadso, Eidfjord, Odda, Sandesjoen, Leirvick, Trangisvaag, Thorshavn, Amsterdam, and Lorient during the cruise. H.M.S. *Glasgow* visited Gdynia, Poland, from 1st to 4th July, the first British naval visit, it was stated, to a Communist-*bloc* port since the end of the war.

Norway Presentations.—Mementoes from H.M.S. *Devonshire*, which brought King Haakon and the Norwegian Government to safety in the United Kingdom in June, 1940, and which is now being broken up, were given to King Haakon and the cities of Oslo and Tromso on behalf of the Board of Admiralty by Admiral of the Fleet Sir John Cunningham, who was Flag Officer, First Cruiser Squadron, in June, 1940, at the time of the evacuation of Norway. He proceeded to Oslo from Portsmouth in the aircraft carrier *Bulwark*, arriving on 1st June.

Channel N.A.T.O. Exercise.—A two days' N.A.T.O. anti-submarine and convoy exercise took place in the English Channel from 23rd to 25th May, conducted jointly by the Naval and Air Commanders of the Channel Command. British, French, and

Netherlands naval forces and British and French maritime air forces took part, returning afterwards to Plymouth for discussion.

MINESWEEPING, DENMARK.—Seven coastal minesweepers of the Inshore Flotilla left their base at Harwich on 12th May to sweep a small area off the Danish island of Sjaelland, which was mined by the Allies during the war and had not been fully cleared. The operation, " Great Dane," was conducted at the invitation of the Danish authorities.

MEDITERRANEAN.—H.M.S. *Newfoundland*, on passage through the Mediterranean to the Far East Station, called at Argostoli on 5th April to deliver the final instalment of stores provided by the British Earthquake Relief Fund.

The cruiser *Glasgow*, two destroyers, and four frigates returned to the United Kingdom in April from service in the Mediterranean. Four " Daring " class ships, the *Duchess*, *Diamond*, *Diana*, and *Decoy*, returned at the beginning of July.

EAST INDIES.—Agreement having been reached between the Indonesian, Indian, and United Kingdom Governments, and at the request of the Indian authorities, the boom defence vessel *Barford* left Singapore late in April to undertake the salvage of the India Airways aircraft " Kashmir Princess," lying in six fathoms of water close off the west coast of Great Natuna Island. H.M. surveying ship *Dampier*, with the help of Indonesian authorities, had previously located the wreck.

FAR EAST.—A combined fleet of seven Royal Navy, five Royal Australian Navy, and three Royal New Zealand Navy ships anchored in Singapore roads early in June and dressed overall in honour of The Queen's birthday on the 9th. The fleet was commanded by the Flag Officer Second-in-Command, Far East, Vice-Admiral R. F. Elkins, in the cruiser *Newcastle*, and had been engaged in exercises to the south of Singapore. It was the largest gathering of warships in these waters for exercises since before the 1939–45 War. Further exercises were held later in which the Royal Malayan Navy joined.

In Operation " Rex," which is being undertaken by the 1st/2nd Gurkhas to clear a jungle area in south-east Johore, ships and motor launches of the Royal Navy and Royal Malayan Navy and helicopters of 848 Naval Air Squadron have been able to lend valuable assistance. From the beginning of the operation in March an intermittent harassing fire has been kept up. The ships taking part have included the cruisers *Newfoundland* and *Newcastle*, the destroyer *Cockade*, the despatch vessel *Alert*, and H.M.M.S. *Pelandok*.

SOUTH ATLANTIC.—The frigates *Pelican* and *Magpie* and submarine *Acheron* left Simonstown on 20th May for Durban, where they were joined on the 24th by the cruiser *Birmingham*, when all three began an exercise period and cruise on the east Coast of Africa. The *Magpie* flew the flag of the Commander-in-Chief, Vice-Admiral I. M. R. Campbell, during certain periods of the cruise. The *Acheron* had left Portsmouth on 20th April to sail round the Cape of Good Hope to Trincomalee and back through the Mediterranean on a six months' cruise for gravity surveys of portions of the earth's crust below the oceans.

SINKING OF H.M.S. SIDON

At 0825 on the morning of 16th June an explosion occurred in a torpedo in H.M. submarine *Sidon* at Portland as she was lying alongside her parent ship, H.M.S. *Maidstone*. She had embarked torpedoes and was about to go to sea for firing practices. There was a sudden uprush of air and smoke through the conning tower hatch. Survivors started to escape and the captain, Lieutenant-Commander H. T. Verry, and other officers and men who were on the bridge of the submarine, as well as officers from the *Maidstone*, entered the vessel to assist in rescue operations. At 0845, while these were in progress, the submarine sank very quickly by the bow.

Three officers, Lieutenant-Commander (E) J. K. Needham, Lieutenant J. M. W. Rycroft, and Surgeon Lieutenant C. E. Rhodes, R.N.V.R., and ten ratings lost their lives. The number on board the *Sidon* at the time of the explosion was 56.

The wreck was raised on 23rd June and beached next day, the 13 bodies being recovered on the 25th.

Personnel

Dartmouth Jubilee.—The Britannia Royal Naval College, Dartmouth, celebrates its fiftieth anniversary this summer. Naval cadets have been trained at Dartmouth since 1863, at first in the training ship *Britannia*, berthed in the river, and since September, 1905, in the Naval College. The Jubilee was celebrated during the week-end of 2nd-3rd July, when the events included a dinner party for present and former officers and masters of the College, at which the guest of honour was the First Lord of the Admiralty.

The new training squadron in which cadets and midshipmen of the College will serve before joining ships of the Fleet as sub-lieutenants will be formed early in 1956. It will comprise the destroyer *Carron*, now modernizing at Chatham, the fast frigates *Venus* and *Vigilant*, and the fleet minesweepers *Jewel* and *Acute*.

In order to provide additional accommodation at the College, H.M.S. *Hawke*, the Upper Yardmen's Training Establishment, has been transferred from Dartmouth to Port Edgar and renamed H.M.S. *Temeraire*.

Devonport Barracks.—The newly-completed accommodation block for chief petty officers and petty officers borne in the Royal Naval Barracks, Devonport, was opened on 1st July by the First Lord, Mr. J. P. L. Thomas, M.P. It is called the Cunningham/Fraser Block, after Admirals of the Fleet Lord Cunningham of Hyndhope and Lord Fraser of North Cape. The building, reputed to be the largest in Plymouth, contains many features new to Service life in a barracks.

Chatham Barracks.—The freedom of the Borough of Gillingham was presented to H.M.S. *Pembroke*, the Royal Naval Barracks at Chatham, at a ceremony on the parade ground of the establishment on 28th June. It is believed to be the first time that a town has accorded this honour to a shore base of the Royal Navy.

Materiel

Launches.—Princess Marie Louise on 23rd May performed the naming ceremony at the launch of H.M.S. *Leopard*, the third of a new type of anti-aircraft frigate, the others being the *Puma* and *Lynx*. The *Leopard* was the first ship to be built on the building slip at Portsmouth Dockyard since 1942. With an extreme length of 340 ft. and a beam of 40 ft., she will be armed with four 4.5-in. guns and will have two additional small guns and a "squid" anti-submarine mortar.

The Countess of Home, wife of the Minister of State for Scotland, performed the naming ceremony at the launch of the *Chichester*, one of the new type of air direction frigates, on 21st April. Of the same length and beam as the *Leopard*, her main armament will consist of two 4.5-in. guns and she will have two smaller guns.

Acceptances.—H.M.S. *Highburton*, the first of the coastal minesweepers to be powered by the Napier Deltic light-weight Diesel engines, was accepted from the builders, Messrs. J. I. Thornycroft and Co., Ltd., Southampton, on 21st April.

The fast patrol boat *Dark Aggressor*, the first of a new class powered by Napier Deltic engines, was accepted on 3rd June from Messrs. Saunders Roe at their Beaumaris, Anglesey, yard. These boats are of composite construction, aluminium alloy being used for the framing and deck. The hull is planked with two diagonal mahogany skins. The craft are 71 ft. 4 in. in extreme length and have a beam of 19 ft. They can be armed either as gunboats or torpedo boats, or for a dual role.

Trials.—The trials cruiser, H.M.S. *Cumberland*, left for the Mediterranean at the end of May to carry out a further series of full-scale tests of new equipment shortly to be fitted in the Fleet. The new fully automatic medium calibre anti-aircraft gun is one of the main items. Further measures to counteract the effect of atomic attack are under trial. The automatic system for washing down the ship's upper works, used last year,

has been extended to cover the whole ship. Other innovations under trial include a 25-ft. motor cutter made of fibre glass.

H.M.S. *Grey Goose*, which served as a steam gunboat in the 1939–45 War, has been converted to a floating test bed, and was commissioned on 22nd June for service with the Trials Squadron at H.M.S. *Hornet*, Coastal Forces Base at Gosport. Two experimental Rolls-Royce RM.60 marine gas turbines of advanced design have been installed in her.

A means of individual escape from submarines known as the one man escape chamber was tried in the week ending 11th June from H.M. submarine *Solent*, which dived for the purpose to the sea bed at Loch Ewe.

To test the efficiency of the preservation methods used to dehumidify certain reserve ships, the frigate *Eglinton*, laid up in the Hartlepool Sub-Division of the Reserve Fleet, was brought forward in June and prepared for operational service in the shortest possible time.

ROYAL NAVAL RESERVES

It was announced on 18th April that retired officers and officers of the Reserves will conform with the changes in titles and uniforms announced by the First Lord on 3rd March for officers of the non-executive branches of the Royal Navy (see the May, 1955, issue of the JOURNAL, page 308). The new regulations involve the dropping of the title suffixes (E), (L), and (S) except for Branch Officers, and the discontinuation of the wearing of coloured distinctive cloth by other than Medical, Dental, and Wardmaster officers. Officers of the Special Branch of the Royal Naval Volunteer Reserve will, however, continue to use the suffix (Sp.) and wear the appropriate distinction cloth pending furtner instructions.

ROYAL MARINES

CAPTAIN GENERAL.—The Duke of Edinburgh visited Plymouth Group, Royal Marines, on 24th May in his capacity as Captain General of the Corps, accompanied by the Commandant General, General Sir John Westall. At the Infantry Training Centre, Lympstone, he saw Regular and National Service recruits in training. At 42 Commando, Bickleigh, he saw various aspects of Commando training. Finally he watched Commando landing exercises in Plymouth Sound and a cliff assault.

200TH ANNIVERSARY.—The Regimental Colour of the Royal Marines Barracks, Eastney, was trooped on 23rd April to mark the Corps day of reunion and to commemorate the 200th anniversary of the establishment of the Corps under the Board of Admiralty. The salute was taken by the First Lord, Mr. J. P. L. Thomas. The Commandant of the United States Marine Corps, General Lemuel C. Shepherd, was among those present.

HALF-YEARLY PROMOTIONS.—The following were notified to date 30th June, 1955 :—

Lieutenant-Colonel to Colonel.—B. W. de Courcy-Ireland, D.S.C.; D. H. W. Saunders, O.B.E.

Major to Lieutenant-Colonel.—R. A. Pigot (acting Colonel); R. H. W. Kirby (local Lieutenant-Colonel).

FREEDOM OF PLYMOUTH.—The Honorary Freedom of the City of Plymouth was conferred on the Royal Marines at a ceremony on Plymouth Hoe on 7th May in commemoration of the 200th anniversary of the formation of Plymouth Division.

EXERCISES.—About 200 ranks of 42 Commando carried out an exercise, " Midnight Sun," in Norway between 28th June and 8th July, taking passage in three frigates. Although small parties of Royal Marines had visited Scandinavia for mountain and Winter warfare training, this was the first time that a Commando had conducted a full scale exercise in the area.

The annual amphibious warfare demonstration " Run Aground VI " was held this year at Browndown on 16th and 17th May. It included the tactical use of helicopters and a demonstration of commando cliff assault at Culver Cliff, Isle of Wight.

DOMINIONS AND COLONIES

CANADA

A.C.N.S. (AIR).—Captain H. P. Sears, R.N., has been appointed Assistant Chief of Naval Staff (Air) and a member of the Canadian Naval Board, and has been granted the rank of Commodore Second Class while holding these appointments.

PROMOTIONS.—The following have been promoted in the Half-Yearly List :—

Commander to Captain.—C. P. Nixon, D.S.C., C.D.; J. C. O'Brien, C.D.; T. C. Pullen, C.D.

Commander to Acting Captain.—F. W. T. Lucas, C.D.

Commander (E) to Captain (E).—J. S. Somers.

Commander (L) to Captain (L).—J. M. Doull, C.D.

Royal Canadian Navy (Reserve).—Commander to Captain.—L. D. Stupart, C.D. *Surgeon Commander to Surgeon Captain.*—D. M. Bean.

TELEVISION TEST.—Television is being installed experimentally in a ship of the Royal Canadian Navy. Its purpose is to communicate visually to various key points in the ship tactical information that has hitherto been transmitted by telephone. A television camera, which operates over a closed circuit from the ship's operations room, will be focused on the plotting chart, upon which the movements of enemy aircraft, surface or undersea craft, as well as those of friendly ships, will be recorded.

AUSTRALIA

BIRTHDAY HONOUR.—The following was included in the Birthday Honours List :—

C.B.—Rear-Admiral R. R. Dowling, C.B.E., D.S.O., First Naval Member and Chief of Naval Staff, R.A.N.

HALF-YEARLY PROMOTIONS.—The Australian Commonwealth Naval Board announce that Captain (acting Rear-Admiral) H. M. Burrell, C.B.E., A.D.C., has been promoted to Rear-Admiral in H.M. Australian Fleet, to date 7th July, 1955.

The following were announced by the Board to date 30th June, 1955 :—*Commander to Captain.*—C. M. Hudson; *Surgeon Commander (D) to Surgeon Captain (D).*—D. O. Southby.

AIRCRAFT CARRIER'S RETURN.—H.M.S. *Vengeance*, light fleet carrier, which has been on loan to the Royal Australian Navy since November, 1952, is to be returned to the Royal Navy this Summer. She left Sydney on 16th June for Devonport. It is intended to replace her by H.M.A.S. *Melbourne*, which is being completed for the Australian Government by Vickers-Armstrongs, Ltd., Barrow-in-Furness.

NEW ZEALAND

BIRTHDAY HONOUR.—The following was included in the Birthday Honours List :—

C.B.—Commodore Sir Charles Madden, Bart., A.D.C., R.N., lately Chief of Staff, R.N.Z.N.

APPOINTMENTS.—Captain C. H. Campbell, R.N., has been appointed Second Naval Member, New Zealand Naval Board; Commander G. H. Stanning, R.N., has been appointed Third Naval Member, New Zealand Naval Board, with acting rank of Captain.

INDIA

MEDITERRANEAN CRUISE

An Indian Naval Squadron and ships of the Mediterranean Fleet, after visiting Marmarice, Turkey, carried out exercises in the eastern Mediterranean while proceeding to Malta in the third week of June. The Indian Squadron consisted of the cruiser *Delhi* and the destroyers *Rajput, Godavari, Ganga,* and *Gomati,* and was commanded by Rear-Admiral Sir St. John Tyrwhitt.

SOUTH AFRICA

Anti-submarine Exercises

Joint inter-Allied anti-submarine exercises took place off the South African coast at the end of June. An ' enemy ' submarine represented by H.M.S. *Acheron* was hunted by H.M. Ships *Pelican* and *Magpie*, the South African Ships *Simon Van der Stel* and *Transvaal*, and the French ship *Gazelle*. Co-operating in the task of defending the convoy, represented by the South African Ship *Somerset*, were Sunderland and Ventura aircraft of the South African Air Force, Shackletons of the R.A.F., and French aircraft from Madagascar. The exercises, under the operational control of the Commander-in-Chief, South Atlantic, Vice-Admiral I. M. R. Campbell, were directed from an inter-Service headquarters at the South African naval base at Salisbury Island, Durban.

FOREIGN

CHILE

Order for Destroyers.—Vickers-Armstrongs, Ltd., announced on 20th May that they had received an order from the Chilean Government for the construction of two destroyers at their Barrow shipyard. The propelling machinery and armament for the vessels will also be supplied by Vickers-Armstrongs.

Visit to Europe.—It was announced at Santiago on 29th May that Vice-Admiral Victor Oelckers, Rear-Admiral Manuel Quintana, and Commodore Arturo Oxley, of the Chilean Navy, would visit Britain in mid-July at the invitation of the Admiralty. Afterwards Vice-Admiral Oelckers was to go to West Germany at the invitation of the Bonn Government.

FRANCE

Salute to President.—On 13th May, the battleship *Jean Bart*, carrying the President on an official visit to Denmark, accompanied by the destroyer *Surcouf*, was met by H.M.S. *Tyne*, flagship of the Commander-in-Chief, Home Fleet, and H.M.S. *Apollo*, 20 miles north of the River Seine. Both ships fired a salute of 21 guns, and signals were exchanged between Admiral Sir Michael Denny and President Coty.

Thames Visit.—The destroyer *Surcouf* arrived in the Thames on 14th June for a four-day visit to London, and was berthed at Greenwich Tier.

GREECE

Withdrawal from N.A.T.O. Exercises

It was announced in Athens on 29th May that N.A.T.O.'s Mediterranean Headquarters in Malta had acceded to the Greek Government request that Greece be excluded from all Allied exercises until further notice. Greece, it was stated, was unable to take part in costly manœuvres because of the engagement of troops and naval staff in the reconstruction of the earthquake-stricken area of Volos, and through scarcity of fuel.

THE NETHERLANDS

Presentations to Britain

On 11th May, at the Royal Naval Barracks, Portsmouth, Vice-Admiral A. de Booy, Commander-in-Chief of the Royal Netherlands Navy, presented to the Royal Navy a painting by the Dutch marine artist, Lodolf Backhuysen (1631–1708), of the Dutch ship *De Zon* anchoring off Den Helder. An inscription on the frame states that the presentation was made in recognition of the hospitality received in Britain during the 1939–45 War.

On 16th May, the Commandant of the Royal Netherlands Marines, Major-General H. O. Romswinckel, who was visiting the United Kingdom to attend the amphibious demonstration " Run Aground VI " at Portsmouth, called on the Commandant General, Royal Marines, General Sir John Westall, to present a plaque commemorating the hospitality offered to a force of Dutch Marines who spent a short time at the Portsmouth Division in May, 1940, after the fall of Holland.

RUSSIA

Return of Lend-Lease Ships

It was announced in Washington on 27th May that Russia had formally agreed to return to the United States 62 small vessels obtained under the Lend-Lease Act during the 1939–45 War. Part of a total of 186 over which the United States has been negotiating since 1948, this group was to be handed over at Kiel in July and August. Another 27 will be returned in Japan this Summer and 38 were restored to the United States last year at Istanbul.

SPAIN

Agreement with U.S.A.

The United States Embassy in Madrid announced on 3rd May that Spain and the U.S.A. had signed an agreement on naval aid designed to give Spain a substantial modern naval fleet. The agreement provides for the modernization of Spanish ships with new armaments, radar, fire control apparatus, and modifications to provide greater comfort for crews. Some of the equipment will be furnished by the United States and the rest manufactured in Spain and other European countries. On 3rd June, the third warship to be transferred to Spain under the mutual defence agreement signed in 1953 was handed over to the Spanish Ambassador at Brooklyn Navy Yard. This was an anti-magnetic minesweeper.

UNITED STATES

Chief of Naval Operations

President Eisenhower on 25th May nominated Rear-Admiral Arleigh Burke to succeed Admiral Robert Carney as Chief of Naval Operations. Admiral Carney will retire in August. Rear-Admiral Burke, who is 53, was a noted destroyer commander in the 1939–45 War and has lately commanded the Atlantic Fleet Destroyer Force. This nomination, said *The Times* Correspondent in Washington, offers him promotion above 90 other naval officers who are senior to him in the Service. His appointment will carry the rank of full admiral.

ARMY NOTES

GREAT BRITAIN

H.M. The Queen

The Queen, accompanied by the Duke of Edinburgh, presented Colours to the 1st Battalion, The Queen's Own Cameron Highlanders, at Balmoral Castle on 30th May.

The Queen presented Colours to the Honourable Artillery Company at Armoury House, Finsbury, on 20th July.

Queen Elizabeth The Queen Mother presented Colours to the 1st Battalion, The Bedfordshire and Hertfordshire Regiment, of which Her Majesty is Colonel-in-Chief, at Assaye Barracks, Tidworth, on 25th April.

The Princess Margaret, Colonel-in-Chief of the Regiment, presented Colours to the 1st Battalion, The Suffolk Regiment, at Wuppertal (Germany) on 23rd May.

The Duke of Edinburgh visited the 4th/5th Battalion, The Queen's Own Cameron Highlanders, at Hawick on 29th June.

The Duke of Edinburgh visited The Leicestershire Yeomanry (Prince Albert's Own) in training at Lulworth and Bovington Camp on 18th July.

The Duke of Gloucester inspected the 1st Battalion, Scots Guards, at Wellington Barracks on 27th April, and K Company, Scots Guards, at Caterham on 5th May.

The Duke of Gloucester, as Colonel-in-Chief of the Rifle Brigade, visited the Green Jackets Depot at Winchester on 8th June.

The Duke of Gloucester opened the new Territorial Army Centre at Swansea on 28th June.

The Princess Royal, Colonel-in-Chief, visited Southampton on 2nd May and met the 1st Battalion, The West Yorkshire Regiment (P.W.O.), on the Battalion's return from overseas.

The Princess Royal, Controller Commandant, Women's Royal Army Corps, visited the 12th Battalion, W.R.A.C., at Richmond Park Camp on 12th May.

The Queen has been graciously pleased to approve the following appointments :—

To be Aide-de-Camp General to Her Majesty.—General Sir George W. E. J. Erskine, G.C.B., K.B.E., D.S.O. (26th June, 1955), vice General Sir Ouvry L. Roberts, G.C.B., K.B.E., D.S.O., M.A., tenure expired.

To be Aide-de-Camp to Her Majesty.—Brigadier C. Hunt, R.A.O.C. (20th May, 1955), vice Major-General G. O. Crawford, C.B.E., promoted.

To be Honorary Physician to Her Majesty.—Colonel A. G. Flemming, O.B.E., T.D., M.R.C.S., L.R.C.P., R.A.M.C., T.A. (21st January, 1955), vice Colonel G. J. V. Crosby, C.B.E., T.D., M.D., transferred to T.A.R.O.

To be Honorary Dental Surgeon to Her Majesty.—Major-General D. J. Muil, O.B.E., late R.A.D.C. (2nd April, 1955), vice Major-General J. Wren, C.B.E., F.D.S., retired.

To be Colonels of Regiments.—Of the 3rd The King's Own Hussars, Lieut.-Colonel Sir Douglas W. Scott, Bart. (1st May, 1955), vice Colonel (Honorary Brigadier) G. E. Younghusband, C.B.E., resigned ; of The Oxfordshire and Buckinghamshire Light Infantry, Major-General Sir T. John W. Winterton, K.C.B., K.C.M.G., C.B.E. (15th September, 1955), vice General Sir Bernard C. T. Paget, G.C.B., D.S.O., M.C., tenure expired ; of The King's Shropshire Light Infantry, Lieut.-General Sir Ernest E. Down, K.B.E., C.B. (5th May, 1955), vice Major-General J. M. L. Grover, C.B., M.C., resigned ; of The North Staffordshire Regiment (The Prince of Wales's), Brigadier (Honorary Major-General) C. R. A. Swynnerton, C.B., D.S.O. (1st June, 1955), vice Brigadier (Honorary Major-General) W. D. Stamer, C.B., C.B.E., D.S.O., M.C., resigned.

Honours and Awards

H.M. The Queen's Birthday Honours.—The following were included in the Birthday Honours List :—

G.C.B.—General Sir George W. E. J. Erskine, K.C.B., K.B.E., D.S.O.; General Sir Gerald W. R. Templer, G.C.M.G., K.C.B., K.B.E., D.S.O.

K.C.B.—Lieut.-General Sir Colin B. Callander, K.B.E., C.B., M.C.; Lieut.-General C. S. Sugden, C.B., C.B.E.

C.B.—Major-General E. G. Brown, C.B.E.; Major-General K. C. Cooper, D.S.O., O.B.E.; Major-General P. Le M. S. Stonhouse-Gostling, C.B.E.; Major-General B. P. Hughes, C.B.E.; Major-General R. C. M. King, D.S.O., O.B.E.; Brigadier G. R. McMeekan, D.S.O., O.B.E.; Major-General F. D. Moore, C.B.E.; Major-General A. Sachs, C.B.E., Q.H.P., M.D., M.R.C.P.; Brigadier E. T. C. Smith, C.B.E.; Major-General J. Wren, C.B.E., Q.H.D.S., F.D.S.

K.B.E.—Brigadier H. Shapcott, C.B., C.B.E., M.C.; Major-General G. A. N. Swiney, C.B., C.B.E., M.C.

Royal Red Cross, First Class.—Major Edith C. Long, Q.A.R.A.N.C.

Kenya.—The following was included on 19th July in the list of awards published in the Supplement to *The London Gazette* of 15th July, in recognition of distinguished service in Kenya during the period 21st October, 1954, to 20th April, 1955 :—

C.B.—Major-General (temporary) W. R. N. Hinde, C.B.E., D.S.O., A.D.C.

Army Council

The Queen has been pleased by Letters Patent under the Great Seal bearing the date 1st June, 1955, to appoint the following to be Her Majesty's Army Council :—

Brigadier the Rt. Hon. A. H. Head, C.B.E., M.C.—*President.*
Brigadier F. H. R. Maclean, C.B.E.—*Vice-President.*
Field-Marshal Sir John Harding, G.C.B., C.B.E., D.S.O., M.C.
General Sir Cameron G. G. Nicholson, G.C.B., K.B.E., D.S.O., M.C., A.D.C.
Lieut.-General Sir Maurice S. Chilton, K.B.E., C.B.
Lieut.-General W. P. Oliver, C.B., O.B.E.
Lieut.-General Sir A. Dudley Ward, K.B.E., C.B., D.S.O.
Sir George W. Turner, K.C.B., K.B.E.

Appointments

War Office.—Brigadier G. P. D. Blacker, C.B.E., appointed Director Mobile Defence Corps, with the temporary rank of Major-General (20th April, 1955).

Lieut.-General Sir Maurice S. Chilton, K.B.E., C.B., appointed Quarter-Master-General to the Forces (1st June, 1955). Substituted for the notification in the February, 1955, Journal.

Major-General B. P. Hughes, C.B.E., appointed Major-General Royal Artillery, Anti-Aircraft (1st June, 1955).

Major-General W. H. Lambert, C.B., C.B.E., appointed Director of Personnel Administration (2nd June, 1955). Substituted for the notification in the February, 1955, Journal.

Major-General K. Bayley, C.B., C.B.E., appointed Director, Boys Training (June, 1955).

Major-General C. L. Firbank, C.B., C.B.E., D.S.O., appointed Director of Infantry (October, 1955).

Brigadier G. A. T. Pritchard, C.B.E., appointed Director of Fortifications and Works, with the temporary rank of Major-General (November, 1955).

UNITED KINGDOM.—Colonel (temporary Brigadier) C. L. Richardson, C.B.E., D.S.O., B.A., appointed Commandant, Royal Military College of Science, with the temporary rank of Major-General (18th May, 1955).

Brigadier J. M. K. Spurling, C.B.E., D.S.O., appointed Chief of Staff, Headquarters, Northern Command, with the temporary rank of Major-General (1st June, 1955).

Brigadier R. Delacombe, C.B.E., D.S.O., appointed G.O.C., 52nd (Lowland) Infantry Division and Lowland District, with the temporary rank of Major-General (October, 1955).

S.H.A.P.E.—Brigadier J. N. Carter, C.B.E., appointed Assistant Chief of Staff (Organization and Training), with the temporary rank of Major-General (November, 1955).

GIBRALTAR.—Lieut.-General Sir Harold Redman, K.C.B., C.B.E., appointed Commander-in-Chief (20th May, 1955).

FAR EAST LAND FORCES.—Colonel (temporary Brigadier) T. B. L. Churchill, C.B.E., M.C., appointed Major-General in charge of Administration, General Headquarters, with the temporary rank of Major-General (June, 1955).

PROMOTIONS

Lieut.-General.—Temporary Lieut.-General to be Lieut.-General :—H. Murray, C.B., D.S.O. (28th March, 1955).

Major-Generals to be temporary Lieut.-Generals :—G. W. Lathbury, C.B., D.S.O., M.B.E. (2nd May, 1955) ; W. P. Oliver, C.B., O.B.E. (15th May, 1955).

Major-Generals.—Temporary Major-Generals or Brigadiers to be Major-Generals :—A. J. H. Dove, C.B., C.B.E. (27th March, 1955) ; R. G. S. Hobbs, D.S.O., O.B.E. (28th March, 1955) ; W. R. Cox, D.S.O. (28th March, 1955) ; V. D. G. Campbell, D.S.O., O.B.E. (29th April, 1955) ; W. G. Fryer, C.B.E., E.M. (2nd May, 1955) ; G. O. Crawford, C.B.E. (20th May, 1955) ; D. D. C. Tulloch, D.S.O., M.C., A.D.C. (11th June, 1955) ; N. P. H. Tapp, C.B.E., D.S.O. (25th June, 1955) ; C. E. R. Hirsch, C.B.E. (28th June, 1955).

Brigadiers or Colonels to be temporary Major-Generals :—G. P. D. Blacker, C.B.E. (20th April, 1955) ; J. R. C. Hamilton, C.B.E., D.S.O. (29th April, 1955) ; R. N. Anderson, C.B.E., D.S.O. (6th May, 1955) ; C. L. Richardson, C.B.E., D.S.O., B.A. (18th May, 1955) ; W. S. Cole, C.B., C.B.E. (28th May, 1955) ; J. M. K. Spurling, C.B.E., D.S.O. (1st June, 1955) ; T. B. L. Churchill, C.B.E., M.C. (6th June, 1955) ; F. W. S. Gordon-Hall, C.B.E. (8th June, 1955).

RETIREMENTS

The following General Officers have retired :—Major-General J. Wren, C.B.E., F.D.S. (2nd April, 1955) ; Major-General Sir Reginald L. Scoones, K.B.E., C.B., D.S.O. (29th April, 1955) ; Major-General P. H. de Havilland, C.B.E. (2nd May, 1955) ; Major-General G. A. N. Swiney, C.B., C.B.E., M.C. (20th May, 1955) ; Major-General W. A. Scott, C.B., C.B.E. (11th June, 1955) ; Major-General H. Bainbridge, C.B., C.B.E. (25th June, 1955) ; Major-General G. C. Humphreys, C.B., C.B.E. (28th June, 1955) ; General Sir Ouvry L. Roberts, G.C.B., K.B.E., D.S.O., M.A. (29th June, 1955) ; Major-General K. Bayley, C.B., C.B.E. (30th June, 1955) ; Major-General S. Lamplugh, C.B., C.B.E. (2nd July, 1955) ; General Sir Gordon H. A. Macmillan of Macmillan (of Knap), K.C.B., K.C.V.O., C.B.E., D.S.O., M.C., D.L. (6th July, 1955).

C.I.G.S's CONFERENCE

The Chief of the Imperial General Staff, Field-Marshal Sir John Harding, will hold his annual conference at Camberley from 17th–19th August. Senior officers of the Commonwealth countries have been invited to attend.

The conference, which will be known as Exercise " Onward," will include discussions on organizational problems that arise when Commonwealth forces are operating together,

and on changes in the organization of field formations and units required to meet the needs of modern war.

Territorial Army Training

The annual field training for the Territorial Army opened early in May when the Headquarters of the 56th (London) Armoured Division, T.A., and of its armoured and lorried infantry brigades with the divisional provost company moved into camp in the Stanford, Norfolk, area on 1st May for 15 days. The H.A.C. Infantry Battalion and a R.A.S.C. transport company of the A.E.R. were also in camp in this area during the same period. On Salisbury Plain during May, units in camp included The Shropshire Yeomanry and a number of Territorial regiments of artillery, while in other parts of the Country those undergoing training included The Yorkshire Dragoons, The Nottinghamshire Yeomanry, and some units of Royal Signals and the R.A.O.C. In July, the 44th (Home Counties) Division, T.A., completed a four-year cycle of training on Salisbury Plain.

British School of Motoring to Train Service Drivers

The British School of Motoring has been appointed by the War Office to train approximately 1,000 National Service men based at Yeovil and Aldershot. This training programme by the B.S.M. will be carried out as an experiment over six months. During that period the same number of men will be trained by the Army and comparisons regarding results and costs will be made.

On the basis of these figures and other relevant considerations, the War Office will decide whether or not driving instruction for a certain number of National Service men will be carried out by civilian contractors.

At present there is a definite shortage of non-commissioned officers for driving instruction of recruits, which means that much of the training is carried out by civilian instructors employed by the War Office. None of the Army's civilian instructors will be affected by this experimental programme.

Though the Army employs civilian instructors, the new scheme is being tried because the number of these civilian instructors is limited, owing to the fact that if there were too great a civilian element in a unit, there would not be enough military staff to undertake the essential military instruction and duties. Moreover, intakes fluctuate and as the Army's civilian instructors cannot be employed on other duties it would be most uneconomic if they were paid for doing nothing when the intake was unexpectedly small. Army instructors, too, do not specialize exclusively in driver training and have to teach other military subjects as well. Thus, no unit can concentrate solely on driver training, as is the case with a civilian organization.

Another reason why the Army is using an outside organization is that vehicles used for driver training are a small fraction of those used in the Army as a whole. As it is not always economic to set up special units to service and repair these vehicles alone, which a civilian organization could do, delays may occur in the training of army drivers owing to the temporary non-availability of vehicles which are under repair.

This experimental scheme also means that the military staff will be able to concentrate on purely military training and offers the advantage arising from the fact that the B.S.M. are specialists in this kind of work and devote their whole time to it.

The Army and the Railway Strike

One hundred thousand men and women, including 3,000 members of army families, were moved by road by the Army during the railway strike. As a result, with the exception of some small restrictions on local leave, the normal movement of all Service personnel was kept going without interruption. In addition, 5,000 tons of military freight were moved by road between ports and depots. "Operation Hotfoot," as this was called, involved 1,400 military vehicles and 1,800 drivers from all Home Commands, together with hired civilian transport.

A further 600 vehicles and 760 drivers assisted the Post Office in operation " Pillar Box " during the duration of the strike. Lorries operated this service on all the main trunk road network between London and the large provincial centres and also between provincial centres.

Regular Army Recruiting

The Regular Army recruiting statistics for June show that the total number of enlistments from civil life during the month were 2,196 men and 76 boys compared with 2,198 and 131 in April and 2,149 and 151 in May. The figures for re-enlistments were 3 from Short Service (April, 5; May, 11) and 366 from National Service (April, 448; May, 456).

War Memorial

The King's Regiment (Liverpool)

A Book of Remembrance, containing the names of all those of The King's Regiment (Liverpool) who fell in the 1939–45 War, was consecrated during morning service at Liverpool Cathedral on 12th June.

Miscellaneous

Tour of the C.I.G.S.—Field-Marshal Sir John Harding, Chief of the Imperial General Staff, paid a short visit to Turkey from 4th to 9th July at the invitation of the Turkish Government.

Corporal Mk. II Guided Missile.—A small party of British officers and non-commissioned officers left for the United States on 1st July for a six months' course in the use of the Corporal Mk. II ground-to-ground guided missile. On their return they will train R.A. units which are to be formed next year to operate the missile. A second course will begin in the United States in January, 1956.

Laying up of Old Colours.—During morning service in Liverpool Cathedral on 12th June, the old Colours of The King's Regiment (Liverpool), which were first carried by the Regiment in 1828, and in the Indian Mutiny, were laid up in the Cathedral. They were handed over by the Colonel of the Regiment, Lieut.-General Sir Dudley Ward, and were received by the Bishop of Rochester.

Kermit Roosevelt Lectures.—Lieut.-General Stanley R. Mickelsen, Commanding General U.S. Army Anti-Aircraft Command, visited England in May to give the Kermit Roosevelt lectures. He lectured at the Royal Military Academy on 3rd May on " Automation and You," and at the Staff College on 10th May his subject was " The Impact of New Weapons on Land Warfare."

Bisley.—The Regular Army won the United Services Challenge Cup. R.Q.M.S. G. Armstrong, Grenadier Guards Training Battalion, won The Queen's Medal and Army Championship. Corporal A. J. Tetlow, Cambridge University O.T.C., won The Queen's Medal and Territorial Army Championship. The Ashburton Shield was won by Winchester College, Marlborough College was second, and Glenalmond College third.

DOMINIONS AND COLONIES

CANADA

Appointments.—Colonel G. C. Leech, O.B.E., C.D., has been appointed Director of Plans and Operations at Army Headquarters, with the rank of Brigadier, with effect from early August.

Colonel C. A. Peck, O.B.E., C.D., has been appointed Director, Royal Canadian Corps of Signals.

Colonel J. S. Ross, D.S.O., C.D., is to succeed Colonel D. Menard, D.S.O., C.D., as Commandant, Calgary Garrison, Colonel Menard having been nominated to attend the National Defence College.

Colonel E. D. Elwood, M.B.E., C.D., has been appointed Commander, Canadian Military Mission Far East, and Military Attaché to the Canadian Ambassador in Japan.

Lieut.-Colonel G. F. Stevenson, C.D., has become Director of Supplies and Transport Army Headquarters, with the acting rank of Colonel, succeeding Colonel J. L. Sparling. O.B.E., C.D., who has become Officer in Charge of Administration, Western Command,

Lieut.-Colonel B. F. Macdonald, D.S.O., has become Director, Royal Canadian Armoured Corps, with the acting rank of Colonel, succeeding Colonel A. G. Chubb, D.S.O., C.D., who has been appointed Military Attaché in Turkey.

ROYAL CANADIAN ARTILLERY CENTENARY.—To mark the centenary of the Royal Canadian Artillery, 26th May was declared Gunners Centennial Day in Canada and a ceremonial parade was held on Ottawa's Commons grounds. Telegrams of congratulation were received from H.M. The Queen, Captain-General, Royal Canadian Artillery, and from Field-Marshal Viscount Alanbrooke, the Master Gunner.

1ST CANADIAN INFANTRY DIVISION.—Approximately 13,000 Regular officers and men of the 1st Canadian Division will have been engaged in field training at Camp Gagetown during this Summer.

TRAINING OF JUNIOR OFFICERS.—Between mid-June and the Autumn, a large number of Regular Army lieutenants and second-lieutenants will have received special training to extend their military and academic knowledge. Two courses have been held this Summer at the Royal Military College, Kingston, and a third will be held in September and October at various corps schools in the country.

MILITIA TRAINING.—About 19,000 officers and men of the Canadian Army (Militia) are expected to have undergone annual Summer training by the end of September in 18 permanent and temporary army centres. Drawn from 284 Militia formations, the greatest numbers will have trained at Camp Petawawa, Niagara-on-the-Lake, and Shilo.

NORTH-WEST HIGHWAY SYSTEM.—Canadian Army engineers completed in April another successful year on the North-West Highway System, the ninth since Canada took over control of the 1,221-mile Canadian stretch of this highway from the United States. Thirteen new steel or concrete bridges replacing original temporary structures were completed, and a 2,326-foot steel and concrete bridge across an arm of Nisutlin Bay near the Yukon-British Columbia border will be completed by December. There are 161 bridges in the Canadian sector of the highway, and they and a number of the 7,000-odd culverts are replaced as the original temporary structures become uneconomical or hazardous. About 700 officers and men with some 800 civilians under army control are employed on the highway, and there are 18 maintenance camps along the road.

CANADIAN WOMEN'S ARMY CORPS TRAINING.—Some 1,000 members of the C.W.A.C. will have attended camps for training in each of Canada's five army commands during this Summer.

TRAINING OF UNDERGRADUATES.—During the period 15th April–15th September, more than 2,000 undergraduates from Services colleges and civilian universities will have undergone training with components of the Canadian Army at home and overseas.

MILITARY EQUIPMENT SENT TO EUROPE.—Shipments sent to the armies of N.A.T.O. countries in Europe between April and June, 1955, included anti-aircraft gun parts and replacements, spare parts for motor vehicles, ammunition, and miscellaneous items.

AUSTRALIA

PROMOTIONS AND RETIREMENTS

Colonel W. D. Refshauge, O.B.E., has been promoted to the rank of Major-General.

Major-Generals F. K. Norris, C.B., C.B.E., D.S.O., E.D., and E. L. Sheehan, C.B.E., have retired.

FOREIGN

BELGIUM

Wellington Museum

To mark the 140th anniversary of the Battle of Waterloo, a Wellington museum has been started in the house which was used by the Duke as his headquarters. To date, the building contains the bed in which the Duke slept, some other furniture which remained after the battle, and some valuable relics including portraits, engravings, and weapons. Manuscripts have been received from the present Duke of Wellington.

FRANCE

Display of Equipment

On 16th June, some 100 miles from Paris, an impressive range of new equipment was displayed by the French Army to foreign military attachés and other visitors. The display, which included radar and transmission units, decontamination and atomic protection units, anti-tank guided missiles, artillery, infantry weapons, armoured vehicles, and helicopters, showed that the French Army will have no lack of modern equipment. Several novel and original items were demonstrated by French National Service men before the visitors, who were obviously impressed.

PORTUGAL

General Botelho Moniz has been appointed Chief of Staff of the Armed Forces, not Chief of the General Staff as reported in the May JOURNAL.

UNITED STATES

APPOINTMENTS.—On 13th May, it was announced that General Maxwell D. Taylor had been appointed Army Chief of Staff in succession to General Matthew B. Ridgway, who retired on 30th June.

HOWITZERS FOR BRITAIN.—The first consignment of the latest U.S. M-44 32-ton self-propelled howitzers for Britain was unloaded at Liverpool on 27th May, as part of the N.A.T.O.-support activities of the U.S. mutual defence assistance programme. These are howitzers of a type which does not exist in the British Army, and they have been given to Britain together with the necessary ammunition so that experience can be gained in their use for N.A.T.O. purposes.

NOTICE

1st Punjab Regimental History

The history of the 1st Punjab Regiment is being compiled by the history section, set up at the Regimental Centre since April, 1954. The task is expected to be completed by the beginning of 1956, and is being done under the guidance of Field-Marshal Sir Claude J. E. Auchinleck, Colonel Commandant of the Regiment.

Contributions in material/information, pertaining to this history, are requested. Any interesting anecdotes, photographs, letters, diaries, personal accounts, information on old Colours and uniforms, or personal recollections should be sent in to the officer in charge History Section, 1 Punjab Regimental Centre, Jhelum, West Pakistan. The material will be securely preserved and, if required, will be sent back to the owner later.

AIR NOTES

GREAT BRITAIN

H.M. The Queen

Presentation of Standard by The Queen.—On 30th June, at the Palace of Holyroodhouse, The Queen presented a new Standard to No. 603 (City of Edinburgh) Squadron, Royal Auxiliary Air Force. Her Majesty is Honorary Air Commodore of the Squadron.

Presentation of Standard by the Duke of Edinburgh.—On 12th July, at Oldenburg, Germany, the Duke of Edinburgh presented a Standard to No. 26 Squadron, 2nd Tactical Air Force.

Honours and Awards

The honours conferred by The Queen on the occasion of Her Majesty's official Birthday included the following :—

K.C.B.—Air Marshal T. G. Pike, C.B., C.B.E., D.F.C.; acting Air Marshal B. V. Reynolds, C.B., C.B.E.; Air Vice-Marshal G. R. Beamish, C.B., C.B.E.

C.B.—Air Vice-Marshal J. G. Elton, C.B.E., D.F.C., A.F.C.; Air Vice-Marshal A. D. Gillmore, C.B.E.; acting Air Vice-Marshal P. S. Blockey, C.B.E., B.A., M.I.Mech.E.; acting Air Vice-Marshal W. A. Opie, C.B.E., A.F.R.Ae.S.; Air Commodore T. C. Dickens, C.B.E.; Air Commodore H. A. V. Hogan, D.F.C.; Air Commodore R. L. Phillips, C.B.E., M.I.E.E.; Air Commodore W. E. V. Richards, C.B.E.; Group Captain K. W. Godfrey, C.B.E.

K.B.E.—Air Marshal F. J. Fressanges, C.B.

Appointments

Air Ministry.—Air Commodore W. C. Sheen, C.B., D.S.O., O.B.E., appointed Director-General of Manning with the acting rank of Air Vice-Marshal (April, 1955).

Bomber Command.—Air Vice-Marshal S. O. Bufton, C.B., D.F.C., appointed Senior Air Staff Officer (October, 1955).

Fighter Command.—Air Vice-Marshal W. G. Cheshire, C.B., C.B.E., appointed Air Officer Commanding No. 13 Group (May, 1955).

Transport Command.—Air Vice-Marshal A. McKee, C.B., C.B.E., D.S.O., D.F.C., A.F.C., appointed Air Officer Commanding-in-Chief (October, 1955).

Technical Training Command.—Air Vice-Marshal G. R. Beamish, C.B., C.B.E., appointed Air Officer Commanding-in-Chief, with the acting rank of Air Marshal (September, 1955).

Home Command.—Air Vice-Marshal F. E. Lipscombe, C.B.E., M.R.C.S., L.R.C.P., D.P.H., D.T.M. & H., Q.H.P., appointed Principal Medical Officer (1st July, 1955).

2nd Tactical Air Force.—Air Commodore W. P. G. Pretty, C.B.E., appointed Air Officer in charge of Administration (April, 1955).

Air Vice-Marshal S. R. Ubee, C.B., A.F.C., appointed Air Officer Commanding No. 2 Group (July, 1955).

British Forces, Aden.—Air Commodore H. A. V. Hogan, C.B., D.F.C., appointed Air Officer Commanding, with the acting rank of Air Vice-Marshal (September, 1955).

Promotions

To be Air Vice-Marshals (*1st July*, 1955).—Air Commodores (acting Air Vice-Marshals) G. P. Chamberlain, C.B., O.B.E.; W. H. Kyle, C.B., C.B.E., D.S.O., D.F.C., A.D.C.; W. C. Sheen, C.B., D.S.O., O.B.E.; R. B. Lees, C.B., C.B.E., D.F.C.; D. G. Morris, C.B., C.B.E., D.S.O., D.F.C.; H. D. Spreckley, C.B., O.B.E.; W. A. Opie, C.B., C.B.E., A.F.R.Ae.S.; F. E. Lipscombe, C.B.E., M.R.C.S., L.R.C.P., D.P.H., D.T.M. & H., Q.H.P. (Medical Branch); Group Captain M. J. Pigott, B.D.S., F.D.S.R.C.S., Q.H.D.S.

Retirements

The following officers have been placed on the retired list:—Air Vice-Marshal G. Combe, C.B. (at his own request to facilitate the promotion of younger officers) (1st April, 1955); Air Vice-Marshal R. L. Ragg, C.B., C.B.E., A.F.C. (29th April, 1955); Air Vice-Marshal E. B. Addison, C.B., C.B.E., M.A., M.I.E.E. (29th April, 1955); Air Commodore J. W. F. Merer, C.B., retaining the rank of Air Vice-Marshal (11th May, 1955).

Flights

Transpolar Flight

The first intercontinental transpolar flight by a jet aircraft was made on 23rd-24th June by Aries IV, the Canberra jet bomber belonging to the Royal Air Force Flying College, Louth. Setting out from Bardufoss, northern Norway, at 1955 hours G.M.T. on 23rd June, it landed at Ladd, Fairbank, Alaska, at 0215 hours G.M.T on 24th June. This works out at an average speed of 507 m.p.h. for the 3,210 miles across the polar cap.

Exercises

Exercise "Sky High"

A six-day Bomber Command exercise "Sky High" took place last April. In some of the practice attacks over 200 Canberras were employed. At the end of the first phase, Air Vice-Marshal A. McKee, Senior Air Staff Officer at Bomber Command, said, "The exercise has given Bomber Command invaluable experience in deploying its large all-jet force of Canberra aircraft under realistic conditions. It has demonstrated in convincing fashion that at extremely short notice Bomber Command can really live up to its motto 'Strike Hard, Strike Sure,' in support of S.H.A.P.E. Many new aspects of the control of a large tactical force have been introduced for the first time. The serviceability of the Canberra force has undoubtedly been higher than in any previous exercise of a similar nature and the number of aircraft unable to take off on their tasks has been negligible. "Sky High" has already taught us many lessons and will make a valuable contribution to improving still further the Command's effectiveness."

Organization

Middle East Air Force Reorganization.—Changes in the Command structure of the Middle East Air Force are taking place due to the redeployment of R.A.F. forces in the Middle East in accordance with Britain's agreements with Egypt and Iraq.

The Command is to be divided into two regional groups subordinate to the Headquarters in Cyprus of Air Marshal Sir Claude Pelly, its Commander-in-Chief.

One group—Air Headquarters, Levant, which is to be responsible for the northern areas of the Command—will have its headquarters at Nicosia in Cyprus.

Headquarters British Forces, Aden, will continue to control R.A.F. units in the southern part of the Command—in Aden Colony and Protectorate, along the South Arabian coast, in Kenya, and the Sudan. To the southern group's area of responsibilities has now been added the Persian Gulf staging posts of Bahrein and Sharjah, previously under the control of the Air Officer Commanding, Iraq.

Following its progressive transfer to Cyprus, Air Headquarters, Levant, will, by the middle of next year, absorb the present Air Headquarters there and control R.A.F. units in Iraq, Jordan, Cyprus, and Libya. It will also be responsible for R.A.F. interests in Egypt when withdrawal from the Canal Zone is complete. Headquarters, No. 205 Group, now in charge of the rundown programme in the Zone, will then be disbanded.

The final R.A.F. nucleus in Iraq will include a small headquarters element overseeing R.A.F. technicians remaining there and controlling R.A.F. operational units visiting Iraq under the agreement. It will also have a mandate for R.A.F. aspects of joint training and planning with the Royal Iraqi Air Force, and the build-up of R.A.F. forces in war as provided for by the agreement.

This regrouping of Middle East Air Force responsibilities will have the effect of placing under one command the predominantly ' air control ' areas of the southern part of the Command. Additionally, it will bring under one command those airfields in the northern area which would form the axis of reinforcement in the Middle East in time of war.

HANDING OVER IN IRAQ.—On 2nd May, the Royal Air Force handed over its base at Habbaniya to the Iraqi Government. Similar ceremonies took place at Shabah and Margil (Basra), the other two establishments maintained by the R.A.F. in Iraq.

MATERIEL

NEW BRITISH PRODUCTION MODELS FLOWN.—During the past few weeks, first production models of two new British aircraft, the Short Seamew and the English Electric Canberra B. Mk. 8, have been completed and test flown. The Hawker Hunter F. Mk. 6 is also now on test at Boscombe Down, and is the fully developed model of the experimental P.1099 Hunter shown at the S.B.A.C. display last year.

FIGHTER EXTREMES.—The level-supersonic English Electric P.1, with its two Armstrong Siddeley Sapphires mounted one above the other, its heavily swept wing of almost delta form, and its many other advanced features, is already the subject of a development batch order for 20 aircraft plus prototypes. The outcome of the intensive trials to be made with these aircraft may set the pattern for the early 1960s. But interest in the other extreme, the light fighter, is increasing and it was reported in June that the Ministry of Supply had ordered from Follands six Orpheus-engined Gnat 1s for development flying. This may be followed by orders for the improved Gnat 2, which it is hoped will have level supersonic capabilities.

MISCELLANEOUS

CHIEF OF THE AIR STAFF.—H.M. The Queen has approved the extension of the appointment of Marshal of the Royal Air Force Sir William Dickson, G.C.B., K.B.E., D.S.O., A.F.C., as Chief of the Air Staff until 31st December, 1956.

PRESENTATION OF TROPHY BY THE PRIME MINISTER.—On 9th July at West Malling Sir Anthony Eden presented the Cooper Trophy to 500 County of Kent (R.Aux.A.F.) Squadron.

MAIL CARRIED DURING STRIKE.—Royal Air Force Transport Command aircraft carried nearly 1,000,000 lb. of G.P.O. mail—the equivalent of 20,000,000 letters—between 1st and 15th June during the rail strike. Four twin-engined Valettas were in constant service flying regular daily mail flights from London and Bristol to Cardiff, Exeter, York, Newcastle, and Edinburgh. They flew 365 sorties, covered 30,000 miles, and logged 223 flying hours.

FOREIGN

EGYPT

EGYPT ORDERS VAMPIRE TRAINERS

Orders have recently been placed with de Havillands for unspecified quantities of Vampire trainers.

GERMANY

WESTERN GERMANY'S AIR FORCE.—The first men of Western Germany's armed forces to be called up are about 200 pilots who are beginning a N.A.T.O. jet conversion course in Germany shortly. They will be followed by a number of German staff officers who will complete a staff course at S.H.A.P.E.

CIVIL AVIATION IN WESTERN GERMANY.—*Deutsche Lufthansa* inaugurated trial flights with its Convair 340s on 1st April, when runs were made from Hamburg and Munich. The aircraft were captained by British pilots with Germans as co-pilots and many of the passengers were invited guests. Commercial flights on European runs were due to start on 15th May. The trans-Atlantic service from Hamburg to New York was started in June with four Lockheed Super-Constellations. For these services *Lufthansa* engaged 11 American pilots of Trans World Airlines. Four more Super-Constellations are due to be delivered in 1956. The British and American pilots engaged by *Lufthansa* will captain the aircraft until the German co-pilots are fully trained.

Meanwhile, the German Aero Club is agitating for the removal of the ban on powered sports flying in view of the activities of *Lufthansa*. The Club stated that there are over 38,000 members of gliding clubs in the Federal Republic and about 1,200 gliders are in use.

INDONESIA

VAMPIRE TRAINER FOR INDONESIA

The de Havilland Aircraft and Engine Companies have received an order for the Vampire jet trainer from Indonesia. This brings to 17 the number of air forces throughout the free world which have chosen the Vampire as their standard advanced trainer.

IRAQ

ROYAL AIR FORCE RANK FOR KING FEISAL II

The Queen has been graciously pleased to approve of the appointment of King Feisal II of Iraq in the honorary rank of Air Vice-Marshal.

ITALY

U.S.A. ORDER FOR AIRCRAFT

The U.S. Government have placed an order with the Italian Company of Fiat for the manufacture of 30 Fiat G-91 light ground attack aircraft. Finance for this contract comes from a special fund for development of weapons for N.A.T.O. The purpose of the order is to enable the type to be fully evaluated by S.H.A.P.E. and the placing of subsequent orders will depend upon the success of evaluation. To date the Italian Air Force has shown no interest in the aircraft, probably preferring to await the result of the S.H.A.P.E. evaluation before making any commitment.

The first Sabre (F-86K) produced by Fiat was test flown early in June. Orders for Fiat-made Sabres now total 120, a further order for 70 aircraft having supplemented the original contract for 50.

JAPAN

JET CONVERSION COURSE

On 28th May, five Air Self Defence Force pilots completed the first jet conversion course conducted for the Japanese under the Mutual Defence Assistance Programme by United States Far East Air Force instructors of the 6025th Flying Training Squadron. The course had begun in January and during its four months duration each pilot flew some 100 hours in Lockheed T.33 jet trainers and received instruction necessary for jet flight in engineering, navigation, physical training, flight operation, and meteorology. The course was conducted at Tsuiki Air Base in Kyushu.

NORWAY

Aircrew Training

Canada has, through N.A.T.O., invited Norway to increase the number of pilot cadets being trained in Canada by 25 per cent. At present Canada provides basic and advanced flying training for 72 Norwegian pilot cadets. The first Norwegians to complete the 15 months course returned to Norway in December, 1954.

PERU

Jet Aircraft for Peruvian Air Force

Three T-33 jet aircraft have arrived in Peru from the U.S.A. and will be used for converting Peruvian Air Force pilots from piston to jet aircraft.

RUSSIA

Soviet Air Day

Soviet Air Day was celebrated on 3rd July at Tushino airfield, near Moscow, by one of the biggest displays held since the war. It was attended by all the Russian leaders.

The display seemed to be intended to impress foreign observers with the rapid progress made in bringing the latest types of inter-continental bombers and supersonic fighters into large-scale production.

Western air attachés were reported as saying that they had seen nearly all the aircraft before, but never so many on show at once. Aircraft said to be on public view for the first time included a four-engined turbo-prop bomber, a four-engined jet transport or passenger plane, and a twin-rotor helicopter capable of carrying 50 men with light guns and vehicles.

The display included a fly past by 12 four-engined jet bombers, known in the West as T-37 Bisons and likened to the American B-52 ; 54 twin-jet medium bombers, known as T-39 Badgers and similar to the American B-47 ; 48 single-jet fighters, said to be like the American Super Sabre ; 50 twin-jet all-weather fighters ; and 23 of the latest MIG-17 fighters. The Bison and Badger have been seen before but never in such large numbers. It is assumed that they are now in full production. Also on show was the glider with flapping wings which was displayed for the first time last year.

SWITZERLAND

Venom Crash

Towards the end of May, the Swiss Air Force suffered its first fatal crash of 1955 and the first involving a Venom. Press reports state that the aircraft suddenly caught fire, and despite desperate efforts on the part of the pilot to save it, a wing came off and it finally exploded, tearing the machine to pieces. Apparently the low altitude at which he jumped prevented the pilot's parachute from opening. The accident rate of the Swiss Air Force is remarkably low ; during 1954, there was one fatality in 43,000 flying hours.

UNITED STATES

Aircraft Production.—The U.S.A.F. has announced that production of the B-52 Stratofortress bomber is to be increased by 35 per cent. at once. The announcement came after the Senate Armed Services Committee had called for a comparison of Soviet and American air strengths. It has also ordered more than 300 Douglas B-66 series twin-jet tactical bombers, including 150 RB-66s. Nine RB-66s now are undergoing flight tests.

ONE-THOUSANDTH THUNDERSTREAK.—The Republic Aviation Corp. has delivered its 1,000th F-84F atom-capable Thunderstreak to the U.S. Air Force in just over a year after the first swept-wing fighter-bombers were assigned to the 506th Strategic Fighter Wing.

BOEING B-47 AND B-52 PRODUCTION.—The Boeing B-47 medium bomber has been in production since 1948 and about 1,500 have been built by Boeing, Douglas, and Lockheed. Strategic Air Command is 80 per cent. equipped with B-47s. The B-52 went into production in 1953 and about 30 have so far been built. It is scheduled for service with S.A.C. by mid-1955.

U.S.A.F. ACCIDENT RATE DECLINES.—Aircraft accidents in the United States Air Force declined last year for the fourth year in succession. There were 20 crashes per 100,000 flying hours in non-combat operations, compared with 38 during the same number of hours in 1950. Fifty per cent. of the total of 1,873 flying accidents in 1954 were due to human error.

NEW BOMBER-FIGHTER LAUNCHING SQUADRON.—The first U.S.A.F. squadron of Republic F-84 fighters, capable of being launched and recovered by B-36 bombers, has been formed.

CONSTRUCTION OF TEXAS TOWERS.—The first of the off-shore radar stations, known as " Texas towers," is being constructed near Cape Cod, Mass.

ROCKET REACHES 123 MILES.—A new type of weather observing rocket, called the Aerobee, has recently reached an altitude of 123 miles at Cambridge, Massachusetts, according to the American Air Force research centre there. The Aerobee is designed to collect atmospheric information at heights up to 135 miles. The Aerobee has been developed by scientists of the Wright Air Development Centre and the American Navy, in co-operation with the Cambridge research centre. It is manufactured by the Aerojet General Corporation of California.

REVIEWS OF BOOKS

GENERAL

Psychological Warfare. By Paul M. A. Linebarger. (Combat Forces Press, Washington.) $6.00.

Nowadays, when we are in a continuous state of war, cold or hot, it seems that the extensive field belongs as much to the psychiatrist as it does to other scientists or to the armed forces. Hence the importance of this book which is now published in its second edition but will be new to most British readers. Dr. Linebarger's exploration of his subject is both wide and deep, and he has now brought his work up to date by including Korea. In this theatre, as an expert on China, he gathered much valuable data while officially employed as a 'consultant.' Incidentally, for five important years, from 1942 to 1947, he served in the Psychological Warfare Department of the U.S. General Staff.

The historical survey starts with Gideon's rout of the Midianites, an action which in a simple age would be classed as a military ruse. Psychological warfare is called one of the decisive weapons of 1914–18 when, it is said, "the British made most of the mistakes and learnt most of the lessons which the Americans were to make and to learn in World War II." No mention is made here of Lord Northcliffe. Proceeding, due consideration is given to the accomplishment of Bolshevik Russia between the wars, and then comes a comprehensive chapter on psychological warfare in the 1939–45 War. Throughout the book, as is only natural, much attention is given to the war in the Far East and the problems set the Americans by the Japanese mentality.

One conclusion is that personnel must be specially trained in advance, in peace-time; but "there is no perfect psychological warrior". The truth of this last statement is amply demonstrated later in the book when principles are carefully enunciated and means and methods meticulously analysed. It is made clear that only a large and flexible organization controlled by specially skilled people can play its legitimate part in the ultimate object—the complete breaking down of the enemy's will to resist.

The post-war survey of 'seven small wars' is rather critical of certain friendly nations—including ourselves. We are told that it took Korea—the United Nations and United States side of Korea—two years to bring its propaganda technique up to the standards of Normandy. (This is certainly true and emphasizes the fact that propaganda is an influence which never ceases.) In 1951, the author flew low over the Chinese positions throwing out leaflets by hand. Actually the self-limitations imposed on the United Nations forces under American command did much to cripple the aims of psychological warfare. "The United States would not accept defeat nor would it seek a decisive victory because victory might have involved the risk of war."

Finally, where so many definitions are in question, the reader may wish to correct his perspective by dwelling on a certain footnote which points out that from a rigidly purist and scholastic angle, psychological warfare is neither psychological nor warfare.

The book is well and profusely provided with explanatory charts and contains reproductions of a great variety of leaflets and other devices emanating from many countries and all charged with the same purpose.

Military Law under the Uniform Code of Military Justice. By William B. Aycock and Seymour W. Wurfel. (University of North Carolina Press.) 60s.

On 5th May, 1950, the Congress of the United States approved legislation establishing a uniform code of military justice for the Army, Navy, Air Force, Marine Corps, and Coast Guard. The act became effective on 31st May, 1951. Concurrently *The Manual for Courts-Martial, United States*, 1951, came into force. Prior to this date separate provisions for trial and punishment were enforced for each of the armed forces. The

uniform code, comprising 140 articles, made substantial revisions in both trial and appellate review procedure, especially so far as the Navy, Marine Corps, and Coast Guard are concerned.

It is of interest to note that the new code, which succeeded the Articles of War, 1920, derives its origin, at any rate in part, from the British legal military code in force at the time of the American Revolution.

The uniform code (published in full in the appendix) provides for a Court of Military Appeals composed of three civilian judges. Up to August, 1954, this Court had rendered more than 500 opinions interpreting the code and the *Manual for Courts-Martial* provisions. The authors have collected this fundamental body of military case law under one cover as a ready reference for those engaged in military law and as a text book for teachers and students.

Students of military law in this Country will find it useful in comparing those points where United States and British military law run parallel and where they diverge. Like our own codes of military law—and possibly because of them—the U.S. code appears to ensure that the scales of justice are never in any way weighted against the accused, and more often than not in his favour. Under the code all cases involving the more serious sentences (e.g. confinement for one year or more) are, after review by the convening officer, passed to a review board composed of not less than three qualified lawyers. Minor cases are reviewed by a judge advocate.

In addition to those cases which are passed to it upon petition of the accused, it is mandatory for the Court of Military Appeals to review all cases in which the sentence, as affirmed by a review board, affects a general or flag officer or involves the death sentence. Similarly the Court must review all cases which the Judge Advocate General orders to be forwarded to it. Subject to certain provisions enlisted personnel (not of the same unit as the accused) may sit as members of a court-martial trying an enlisted man. This is only permitted on the personal request of the accused.

The above are some examples of the points of interest to students of British military law. They will readily find others by reference to the table of contents and index without the necessity of wading through the whole volume.

The Pageant of Heraldry. By Colonel H. C. B. Rogers, O.B.E. (Seeley Service.) 25s.

It is odd that what in inception was a rough-and-ready system of pictorial symbols devised for the enlightenment of the illiterate, should have developed into a highly technical science—or is it art?—demanding quite a high degree of literacy for its comprehension. But so it is with heraldry—or rather, armory, to give it its proper nomenclature. Armory, although in somewhat chaotic use as a means of self-identification previous to the XIIIth Century, was not put on to a sound and systematic footing until half that century had passed.

The need for some form of self-identification in mediaeval days is obvious. For as Sir William Dugdale—Garter Principal King of Arms—pointed out so long ago as 1681, " these Ensigns of Honour, as are commonly called Arms, which of later times have been chiefly used for distinction of families, had their original from the practice of great commanders in war, is not unknown to the learned: for certain it is, that the faces of all great military officers, being obscured by such hoods and helmets as were anciently worn in times of battle, it was expedient that by some other means their persons should be notified to their friends and followers."

At the outset the whole process was capricious and subject to no control, but in due course it came to be governed by strict rule, and acquired a terminology of its own. At first sight, this last-named may appear as baffling as native Choctaw. But careful perusal of Colonel Rogers's lucid pages will speedily reveal the fact that correctly to interpret an Achievement of Arms—not Coat of Arms—presents fewer difficulties, and is far more pleasant, than grappling with the conundrums propounded by *Bradshaw*.

An enthusiast, as befits one who has earned the commendation of the Rothsay Herald and Lyon Clerk, Colonel Rogers possesses the happy gift of infecting the reader with some of his own fervour for the subject under discussion. It is not carping criticism to aver that, rightly taking that self-same reader's abysmal ignorance of the subject for granted, the author has been at infinite pains to expound his subject in terms that can be grasped by the least informed. But even the better instructed will find ample matter for their enlightenment; especially on the cryptic sub-subject of cadency and differencing.

It is interesting to note, incidentally, that the author is inclined to attribute the Black Prince's selection of the triple ostrich plumes as his personal device "for peace," to their introduction into the English Court by his mother, Philippa of Hainault. Nowhere is there any mention of their adoption after the death of the blind King of Bohemia—they were his emblem as well as that of the County of Ostrevant in Hainault—on the field of Crécy, as is more generally believed.

The author's range is catholic enough to include illuminating chapters on ecclesiastical heraldry, the Arms of corporate bodies, armorial seals, and armorial coins. There is also a brief dissertation on Regimental Colours and their origin, which Service readers will find of particular interest.

The work is excellently illustrated throughout; and one can only conclude by borrowing Abe Lincoln's amiable terms of recommendation, "For those who like this sort of book, this is the kind of book they will like."

How to Live Well on your Pension. By W. P. A. Robinson. (Faber and Faber). 12s. 6d.

The criticism which can often be levelled at those who give us advice—free or otherwise—is that it is "do as I say" rather than "do as I do." The author of this entertaining book is not one of these: he has done, and done well, what he advises others to do. His recipe is to avoid boredom and "early rusting away" by living an "active, interesting, and creative life in a tranquil way." He believes in avoiding one or other of those well-known places to which "everyone goes when they retire," to harbour nostalgic memories of past importance, tell and re-tell tales of Cairo or Sweatypore in the good old days. Such resorts, the author suggests, are so bad for idle, elderly gentlemen that they have a "better right to be called the 'White Man's Grave' than the West Coast of Africa."

The author's solution is to buy a small house or cottage in rural England with an acre or two of land or a garden large enough to render the household self-supporting in fruit, flowers, vegetables, eggs, etc., with plenty left over for sale. He goes on to specify what to grow, how to grow it, and how to market produce. But he does not neglect the amenities of house or garden and gives some useful hints on finding and buying the right place. The snags, including finance, are not overlooked.

It is, indeed, a manual of information on the aspects of gardening and other matters which are necessary to the attainment of the object which the author suggests his readers can pursue without overburdening themselves. It is, however, eminently readable, being not only clear and concise, but embellished with flashes of humour or philosophy and even hints on household management and entertaining in such conditions. The author is evidently a soldier who has 'heard the reveille' from Larkhill to Rumblebellypore, and has no desire to re-visit either.

The volume is illustrated with photographs and diagrams, including pictures of the author's cottage and garden 'before and after first-aid.' This is a work which can be recommended to those who have retired, to those on the point of doing so, or to those who are merely dreaming of, or dreading, the inevitable severance from a life's work. Wives should read it, too, for they have a part to play in this recipe for living well on one's pension and staving off approaching 'anecdotage.'

ARMY

Official History of the Indian Armed Forces in the Second World War, 1939-1945. The Arakan Operations, 1942-45. By Lieut.-Colonel N. N. Madan. (Inter-Services Historical Section (India and Pakistan).) Rs. 20.

This is the second volume to be published in the contemplated series of official military histories, now being prepared under the general direction of Dr. Bisheshwar Prasad for the Governments of India and Pakistan. In it the author has dealt solely with the operations in the Arakan. The drawbacks of such a treatment were realized when the book was planned, but it could have only been successfully achieved if the relative events on the main front had been interpolated to show the impact of both fronts on each other and on the course of the Burma campaign as a whole. As it is, no mention is made of the fighting to the north and one is left wondering why the operations in the Arakan in 1944–45 accomplished so much more than those of the previous years.

The story is well told and the various actions are clearly and carefully described, with a wealth of information relating to the enemy's side which has at times prompted the author to describe them through Japanese eyes. The pitfalls inherent in such an approach have, however, been avoided by making clear what information was available to the British commanders at each stage.

The volume starts with the situation as it confronted the Commander-in-Chief in India in May, 1942, when with one British and six Indian divisions, a negligible air force, and with the Japanese in command of the sea, he had to consider the defence of India against any further Japanese aggression westwards. Lord Wavell was the last person to allow any enemy to consolidate his gains, but all through his period of command he was dogged by a shortage of means for putting the best of his plans into operation. So when the monsoon had given him breathing space to reorganize, retrain, and redeploy his scanty forces, he launched the first campaign in Arakan in December, 1942, with the object of retaking Akyab.

Forced by the limitation of resources to use the shortest overland route, this offensive was slowed down by bad communications and finally halted by a remarkable Japanese defence in front of Donbaik and Rathedaung. Strong enemy reinforcements arrived and a counter-offensive, launched across the Mayu range, eventually forced the troops of the XVth Indian Corps to retire behind the line from which they had started, so hopefully, five months before.

After the monsoon in 1943, the second campaign opened in the Arakan with a series of ' biting off ' operations, but the Japanese defences were skilfully held and little progress had been made by the time the enemy undertook a ' large enveloping movement ' early in February, 1944. This offensive was conceived as the prelude to the main Japanese thrust in the north and aimed at the total destruction of the 5th and 7th Indian Divisions, but after a brilliant opening it was totally defeated in three weeks of intensive fighting. The British defended localities, or ' boxes,' which had been prepared with a view to an all-round defence, stood fast and repelled all the assaults made against them. whilst being maintained by the air lift for the first time.

The author rightly assesses this battle in northern Arakan as the crisis of the war in this theatre and emphasises the importance of the defence of the Sinzweya ' box,' but rather loses his perspective when describing some of the minor operations which led to this outstanding success ; when for the first time " a British force had withstood the full weight of a major Japanese offensive—held it, broke it, smashed it into little pieces and pursued it."

The final campaign, after a slow start, really got moving on 12th December, 1944, and, against fading opposition, retook Akyab on 3rd January, 1945, and Gwa on 15th May.

The interest in this offensive lies in the use made of sea-borne assaults at Myebon, Ramree Island, and Ruywa and one cannot help wondering how different the course of the war in this theatre might have been if these resources had been available earlier.

But if the Japanese had been forced to reduce the size of their forces in the Arakan, by the pressure of events on the main front, those remaining were still ready to fight it out to the bitter end, as they did at Kangaw in February.

This volume is a far better production in every way than that previously published, which dealt with the retreat from Burma, but some minor errors occur in Appendices 5 and 6 and though the Japanese story, as a whole, is correct, the comprehensive details included are not as accurate as one would suppose.

The 25 maps included, though well drawn, are not strictly related to the text, where the inclusion of locality nicknames, not shown on any map, sometimes makes the story difficult to follow. Of the 39 illustrations, only 12 attempt to give any idea of the country in which these campaigns were fought and the use of the air oblique photograph for this purpose seems to have been overlooked.

Atomic Weapons and Armies. By Lieut.-Colonel F. O. Miksche. (Faber and Faber.) 25s.

The advent of air forces and armour in the 1914–18 War inspired a sizeable team of military writers who between the two world wars did much to stimulate thought on the future tactics and organization of armies. The advent of guided missiles and the atomic bomb in the 1939–45 War has as yet produced no comparable literary reaction. This may be due to the rapid developments in both these weapons which have taken place in the last decade and to the veil of secrecy with which they have been surrounded. Nevertheless, the general pattern of weapon development is fairly well known and the problems and difficulties facing the Governments and military advisers of the western Powers can be readily appreciated. The author has boldly attempted to analyse these problems and difficulties and indicate solutions. In so doing he aims to stimulate thought and discussion.

He is outspokenly critical of the present policy and organization of the N.A.T.O. military forces. In his view, "the western Powers are basing their strategy on bombs that are too big, on armies that are too small, whereas the East has both at its disposal—the big bombs as well as the big armies."

He examines in detail the divisional organization of the North Atlantic armies and arrives at the conclusion that they are "unwieldly and complicated toys." In their place he advocates a ruthless reduction in staffs and services with a minimum of heavy weapons and transport, resulting in a maximum of fighting personnel armed with rifle, machine-gun, mortar, and other light weapons. Such an organization would approximate to the Russian type of division with its 10,300 men. Only thus, if for financial reasons alone, would it be possible to exploit the full manpower capacity of the western Powers and effectively face the threat of the Soviet massed battalions.

He supports his arguments by a careful analysis of the American type of division and draws the conclusion that it has "a large head, too large a tail, and in between a body which is not in correct proportion." It has speed but not flexibility and by its very mass of vehicles hampers its own movement. Its only suitable role would be against an enemy weak in the air, and in country well equipped with roads. When faced with atomic weapons it would, he surmises, "in all likelihood collapse in the first battles."

To meet the new conditions of atomic warfare Colonel Miksche elaborates the theory that the armies of the future should be divided into five separate categories; atomic forces; infantry divisions, normally organized in corps of three of his new pattern divisions; mechanized forces, based on an enlarged mechanized brigade; rear area troops to counter the threat of tactical atomic weapons; and paratroops and other specialized units. Air forces he would retain in their present strategic and tactical roles.

The author of *Blitzkreig* and *Paratroops* has established his reputation as one of the foremost military writers today. In this volume there is much to criticize, and still more

to provoke discussion. It should be read by all those who are in a position of authority, or who aspire to become so, whether in the military or political spheres.

The Crecy War. By Lieut.-Colonel Alfred H. Burne, D.S.O., F.R.Hist.S. (Eyre and Spottiswoode.) 30s.

"True historical writing", Michelet averred, "is a resurrection of the flesh." By this high standard, mediaeval history is extraordinarily difficult to bring to life, for the sources to which the would-be historiographer must resort are limited in number and often so warped by ecclesiastical animus or partisan misrepresentation as to constitute veritable death traps for the unwary. To no period does this handicap apply more cogently than to that of the Hundred Years' War, of which Chaucer saw the beginning and François Villon witnessed the end.

Colonel Burne, already recognized as an authority on the battlefields of England, has chosen for his theme those opening phases of the century-long struggle which start with the Third Edward's campaign in Flanders of 1337 and end with the patched-up Treaty of Calais, more commonly known as the Peace of Brétigny, of 1360. It is an entirely natural transition, since the entire period was dominated by the prowess of the English soldier, matured on such native battlefields as Halidon Hill, and fighting under the inspiration of an English soldier-king, whose strategic flair and tactical skill have hitherto lacked a chronicler of sufficient military insight to appreciate them at their true worth. For Colonel Burne makes it abundantly clear that the initiative rested almost exclusively with Edward. Operating on exterior lines—a feat rendered far less hazardous when a bridge-head had been established at Calais and at least partial control secured over the Channel—his bold attempts to co-ordinate as many as three converging attacks, in the days of the sketchiest of communication systems, although not always fully successful, at least had the effect of keeping the Gallic forces bewildered and irresolute. When the rival forces did clash, over and over again the relatively small but battle-hardened English men-at-arms and bowmen showed themselves of infinitely finer metal than the numerically superior but militarily unhandy levies brought against them; and never more so than at the two great fights of Crécy and Poitiers.

Colonel Burne has been at infinite pains to present a factually accurate account of some score and more years of extremely complicated history. Amidst the extravagant fanfaronades of Froissart, the Canon of Chimay, and other uninhibited romancers, he has walked with a circumspection to outmatch that of Agag; and his logical, well-trained mind coolly discriminates between the purely fantastic, the doubtful, the unlikely, and the probable; his touchstone in every instance being 'inherent military probability.' It is by such means that he has been able to rescue from undeserved oblivion such neglected stalwarts as Henry of Lancaster, Sir Thomas Dagworth, and Sir William Bentley, his successor as King's Lieutenant in Brittany; men whose martial qualities are overlooked by the average writer as consistently as those of that splendid Elizabethan captain, John Norrys.

It is true that in a work bearing such patent signs of zealous research one would have welcomed a fuller investigation of the incidence of disease and its influence on the course of contemporary warfare. Dysentry, for instance, is known to have played havoc with a mediaeval expeditionary force on more than one occasion. At Harfleur in 1415, for example, this foul affliction carried off the youthful Earl of Suffolk, Michael de la Pole, Bishop Courtney, eight knights, and over 200 of the rank and file; while a large number of the sick were evacuated by men of the Cinque Ports to Southampton. Earlier, at Poitiers, it is on record that the English bowmen were suffering so badly from the scourge that they were compelled to "leave the points of their hose unlaced." (Perhaps their distressing condition helps, in part, to account for the puzzling two-day halt at Chatellerault on the eve of the Poitiers encounter.)

This aspect of affairs apart, there can be nothing but praise for this admirable study of one of the most fascinating periods of military achievement in the whole history of arms.

No Citation. By James Allan. (Angus and Robertson.) 12s. 6d.

This is the tale of a most unusual war experience, clearly and simply written. Lance-Corporal James Allan, Corps of Military Police, late Scots Guards, was wounded during the 1940 campaign in France and fell into German hands while in a military hospital. He was sent to a prison camp at Thorn on the Vistula. The manner of his escape from Thorn, with a Canadian companion, contains many of the elements of farce; but it left him at large in German-occupied Poland, a serious enough situation. However, friendly Poles passed them along until Allan, though separated from his companion, reached Warsaw. Here he remained, a guest of the Polish Resistance, until the opportunity arose for him to cross the river Bug into that part of Poland occupied by neutral Russia. The manner of his crossing was perilous in the extreme, but his sojourn among the Russians proved to be his great ordeal.

The Russians were—or seemed—convinced that Allan, in common with other British soldiers who had reached their territory, had come to spy for the Germans. One may assume that ordinary internment would have been uncomfortable enough; the treatment accorded to a suspect from whom a confession had to be extorted was calculated to break down the morale of the fittest and strongest. Allan, who possessed some linguistic gift, and had acquired certain German, Polish, and Russian phrases, was deemed to know more of these languages than he would admit, and suffered accordingly. He writes freely and frankly—sometimes even humorously—of his struggle to survive in the prisons of Shepatov, Bialystok, Minsk, Moscow, and Saratov.

It was a dreadful existence: bad food, frequent interrogations, repeated searchings, solitary confinements and incarceration in crowded cells, casual executions, a 'beating up,' and threats of Siberia which on more than one occasion seemed to be his ultimate destination. At times he was encouraged to write to the British Ambassador, but his letters were never delivered. He confesses that he came near to total collapse and owed much to the moral support of certain individuals among his fellow prisoners, British and French soldiers, Russian 'politicals,' Polish refugees, and a confessed German spy.

At last, when Russia became an ally by entering the war, he was restored to freedom, being transferred furtively from the Lubyanka prison to the British Embassy. He might so easily have succumbed to physical hardship or moral pressure, have met a violent death, or disappeared into exile; that he did not do so may be attributed to his native Yorkshire qualities and, maybe, his Scots Guards training. His reward was the Distinguished Conduct Medal, without citation.

History of the Army Physical Training Corps. By Lieut.-Colonel E. A. L. Oldfield. (Gale and Polden.) 21s.

The origin of the Corps was the Army Gymnastic Staff formed at Aldershot in 1860, with a strength of one officer and 12 other ranks, seconded from their Regiments. During the 1939–45 War some 5,000 Corps instructors served at home and abroad in every theatre of war. In this history the account of early days, and to some extent the period of the 1914–18 War, is brief owing to lack of records. In fact, five out of eight chapters of the book are concerned with the period 1939–1945. It is, as Field-Marshal Lord Montgomery writes in his foreword, a "story of human endeavour," from which he hopes readers "will gain some inspiration which will be of use in the difficult days that still lie ahead of our Nation." Like many another innovation in the Army, the Corps met with obstruction and criticism, mainly before 1920, but continued to progress. It is, however, a matter of opinion whether the critics were always wrong.

During the 1914–18 War the scope of training carried out by the Army Physical Training Staff was much increased and included the restoration of war-worn men by physical training and games, as well as remedial treatment in hospitals. In 1918, responsibility for bayonet training was transferred to the School of Musketry, a wise decision.

Added responsibilities and tremendous expansion followed the outbreak of the 1939–45 War. The Physical Training Staff was formed into a combatant corps with its present title on 16th September, 1940, and two years later adopted the motto : *Fighting Fit and Fit to Fight*, the originator of which was Field-Marshal Lord Alexander. The scope of the Corps activities was once more widened ; their contribution to eventual victory is well recorded. One chapter deals with the airborne forces and the fine service rendered by personnel of the Corps in training and in action.

The author has succeeded in compiling a book of great interest to members of the Corps, past and present, and to others responsible for the training of troops for war. The volume is well produced and illustrated ; there are the usual appendices and an index.

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